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POLLUTION OF THE INTERSTATE WATERS OF THE LOWER SAVANNAH RIVER AND ITS TRIBUTARIES, SOUTH CAROLINA-GEORGIA. PROCEEDINGS OF CONFERENCE HELD AT SAVANNAH, GEORGIA ON FEBRUARY 2, 1965

Public Health Service
Washington, D.C.

2 February 1965

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PROCEEDINGS

CONFERENCE
on POLLUTION
of the Interstate Waters of the
LOWER SAVANNAH RIVER
and its Tributaries
South Carolina - Georgia

Savannah, Georgia
February 2, 1965

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service

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CONFERENCE
on POLLUTION
of the Interstate Waters of the
LOWER SAVANNAH RIVER
and its Tributaries
South Carolina - Georgia

Convened on the Call of the
Secretary of Health, Education, and Welfare
Under Section 8 of the
Federal Water Pollution Control Act
(33 U.S.C. 466g et seq.)
Savannah, Georgia
Tuesday, February 2, 1965

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Washington, D.C. 20201

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P R O C E E D I N G S

MR. STEIN: The conference is open.

This conference is the matter of pollution of the interstate waters of the mouth of the Savannah River and its tributaries, involving the States of Georgia and South Carolina, and the Department of Health, Education, and Welfare, is being held under the provisions of Section 8 of the Federal Water Pollution Control Act. This conference covers the lower 28 miles of the river, flowing past the industrial area of Chatham County and the City of Savannah and into the Atlantic Ocean near Savannah Beach. Portions of the connecting tidal waters of the New, Wright, and Cooper Rivers in South Carolina are included.

Under the provisions of the Act, the Secretary of Health, Education, and Welfare, is required to call a conference of this type when, on the basis of reports, surveys or studies he has reason to believe that pollution of interstate waters subject to abatement under the Federal Act is occurring.

The purpose of the conference is to bring together the State water pollution control agencies, representatives of the Department of Health, Education, and Welfare, and other interested parties to review the existing situation, to appraise the progress which has been made, to lay a basis for future action, and to give the States, localities, and industries an opportunity to take any remedial action which may be indicated under State and local law.

The conference technique is rather an old one. Is is used informally by many State agencies in the normal conduct of their business in the field of water pollution control. The conference system was proposed by the United States Supreme Court as long ago as 1921 in the famous case of New York against New Jersey involving interstate pollution. I would like to quote from this court opinion:

> "We cannot withhold the suggestion, inspired by the consideration of this case, that the grave problem of sewage disposal by the large and growing population living on the shores of New York Bay is one more readily to be most wisely solved by cooperative study and by conference and mutual concession on the part of representatives of the States so vitally interested in it than by proceedings in any court however constituted."

We strongly support the conference technique and we consider as successes those problems which are solved at the conference table, rather than in court.

As specified in section 8 of the Federal Water Pollution Control Act, the Secretary of Health, Education, and Welfare has notified the official State water pollution control agencies of this conference. These agencies are the Georgia Department of Public Health, and the South Carolina State Water Pollution Control Authority.

Georgia will be represented by Mr. R. S. Howard, Junior, and he is accompanied by Mr. John Venable -- Dr. John Venable, the State health officer.

South Carolina will be represented by Mr. William T. Linton. Mr. Herbert Rogers of the Atlanta Regional Office, of the Department of Health, Eduation, and Welfare has been designated as Conferee for the Federal Government, and my name is Murray Stein. I am from Washington, D.C., headquarters of the Department of Health, Education, and Welfare, and have been designated as Chairman, and representative of the Secretary of Health, Education, and Welfare, Anthony J. Celebrezze.

The representatives of the official agencies are privileged to invite whomever they wish to participate in the conference. However, this is a conference of State representatives and representatives of the Department of Health, Education, and Welfare, and these parties constitute the conference.

Both the States and the Federal Government have responsibilities in dealing with interstate water pollution control problems. The Federal Water Pollution Control Act declares that the States have primary rights and responsibilities for taking action to abate and control interstate pollution. It has always been the policy of the Department of Health, Education, and Welfare to give full recognition to this traditional role of the States, and to encourage them in these activities. At the same time, the Department of Health, Education, and Welfare is charged by law with its own specific responsibilities in connection with interstate pollution control problems.

The Federal Water Pollution Control Act provides that pollution of interstate waters, whether the matter causing or contributing to such pollution is discharged directly into such waters or reaches such waters after discharge into a tributary of such waters, which endangers the health or welfare of persons in a State other than that in which the discharge originate, is subject to abatement. The conference will be useful, we hope, in providing a clear picture of the problem, in delineating the progress which has already been accomplished and in indicating what still needs to be done to correct the problem in these interstate waters.

All of the conferees will be called upon to make statements. The conferees, in addition, may call upon participants whom they have invited to the conference to make statements. At the conclusion of such statements, the conferees will be given an apportunity to comment or ask questions, and at the conclusion of the conferees' comments or questions I may ask a question or two. In the past this procedure has proven effective in reaching equitable solutions. At the end of all the statements, we will have a discussion among the conferees and try to arrive at a basis of agreement on the facts of the situation. Then we will attempt to summarize the conference orally, giving the conferees, of course, the right to amend or suggest modifications of the summary.

Under the Federal Law, the Secretary is required at the conclusion of the conference to prepare a summary of it which will be sent to all the conferees. The summary, according to law, must include the following points:

1. Occurrence of pollution of interstate waters subject to abatement under the Federal Act;
2. Adequacy of measures taken toward abatement of pollution; and
3. Nature of delays, if any, being encountered in abating the pollution.

Subsequent to the holding of a conference, the Secretary of Health, Education, and Welfare is required to make recommendations for remedial action if such recommendations are indicated.

Now, a word about the procedure governing the conduct of this conference. A record and verbatim transcript will be made of the conference. This transcript is for the purpose of aiding us in preparing a summary and also for providing a complete record of what is said here.

We will make copies of the summary and the transcript available to the official State water pollution control agencies of Georgia and South Carolina.

We have found that, generally, for the purpose of maintaining relationships within a Region and a State that the people who wish transcripts should request them through their

State agency rather than come directly to the Federal Government. The reason for this is that we would prefer the people who are interested in the problem to follow their normal relations in dealing with the State agencies rather than the Federal Government on these matters when the conference has been concluded. We will be most happy to make this material available to the States for distribution.

I would suggest that all speakers and participants other than the conferees making statements come to the lectern and identify themselves for purposes of the record.

We have possibly a problem here with all of the pillars in this room. I am overwhelmed by the graciousness of the City and these really beautiful pillars and the type of architecture that you have here. If there is any problem in seeing anywhere in this room, I would suggest that you may want to raise your hand. If there is a problem, we will attempt to make adjustments.

We also have in the Federal establishment a Water Pollution Control Board of nine members appointed by the President of the United States. These board members serve for three years and cannot succeed themselves and three new members are appointed each year. One of the members of the President's Advisory Board is here today and I would like to introduce him, Mr. Hayman Hake, of Minneapolis, Minnesota.

Mr. Hake. (Applause).

At this time I would like to call on Mr. Rogers for the Department of Health, Education, and Welfare. Mr. Rogers.

MR. ROGERS: I am Herbert Rogers, Director for Water Supply and Pollution Control out of Region Four in Atlanta. This region covers six southeastern states, South Carolina, Georgia, Florida, Alabama, Mississippi, and Tennessee.

We have a couple of individuals from the Regional Office. I would like to introduce Mr. Robert Brown, who is our Regional Director, Associate Regional Director for HEW, Region Four. He is back in the audience. And Mr. Howard Chapman, who is the Associate Regional Health Director, Mr. Chapman back here. (Applause).

For the Federal government's presentation at this conference we have present persons from the Division, Program and Sanitary Engineering Center in Cincinnati, Ohio, and persons representing other Federal agencies who have an interest and a responsibility in the water pollution control field. I will introduce each of these as they come up to participate to make their presentation.

The Public Health Service and the Department of HEW has made available to the State agencies copies of a report on pollution of interstate waters of the mouth of the Savannah River. The study leading to the writing of this report was under the direction of F. W. Kittrell who is in charge of the pollution evalution unit in Cincinnati. Mr. Kittrell is present, I believe, somewhere in the audience back over here.

This report deals with the lower twenty-eight miles of the river and will be presented by Mr. Al West, who is on Mr. Kittrell's staff.

And so, Mr. West, we will ask you to come around, if you will, and present this report.

MR. WEST: Mr. Chairman, Conferees, and guests, in presenting this report on the studies of the Savannah River, I would like to enter the full report in the record and then I will attempt to present a condensed version of the report orally here at the conference.

MR. STEIN: Without objection that will be done and will be entered into the record as if read entirely.

(Continued on the next page.)

MR. WEST: Report on Pollution of Interstate Waters of the Mouth of the Savannah River, Georgia-South Carolina.

Summary and Conclusions:

The Savannah River is one of the principal interstate streams in the southeastern States, and for approximately 310 miles it forms the border between Georgia and South Carolina.

This report deals with the lower 28 miles of the river flowing past the industrial area of Chatham County and the city of Savannah and into the Atlantic Ocean near Savannah Beach. Portions of the connecting tidal waters of the New, Wright, and Cooper rivers in South Carolina, are included.

The tidal waters of the Savannah River are used for navigation, commerce, industrial water supply, recreational boating, sport fishing and water contact sports such as swimming and water skiing. The main channels also are used for sewage and industrial waste disposal. These waters once supported commercial American shad and oyster fisheries, but because of pollution discharged to the river, the waters were closed to shellfishing, and these industries no longer exist.

Sewage from a sewered area totaling about 146,000 population is discharged to the Savannah River. One-fifth of the sewage receives primary treatment, which reduces the total bacterial loading by about 10 percent, and the oxygen demand by 7 percent. The remaining four-fifths of the sewage enters the river raw. About 80 percent of the waste constituents of sewage entering the river, or an oxygen demand population equivalent of approximately 108,000, is included in the raw sewage discharged from the city of Savannah. About 10 percent, having a population equivalent of approximately 15,000, is discharged by the Savannah Beach primary sewage treatment plant, and the remaining 8 percent is discharged by other jurisdictions shown in the table of estimated sewage characteristics.

In addition, industries discharge process wastes, cooling water, and chemical wastes, which include oxygen demanding materials estimated to be equivalent to those in raw sewage from a sewered population of approximately 1,000,000. About 90 percent of the oxygen consuming materials in the industrial wastes is discharged by the pulp and paper mills. An estimated 78 percent, having a population equivalent of 810,000, is discharged by Union Bag-Camp Paper Corporation; 12 percent, with a population equivalent of 130,000 by Continental Can Company; and the remaining 10 percent is discharged by the other six industries shown in the table of industrial wastes characteristics.

The combination of sewage and industrial wastes causes pollution of the Savannah River. Bacterial pollution was most severe in the Georgia waters of the main channel (S-14) near the sewage discharges from the city of Savannah, where the average total coliform density of 31,800 MPN/100 ml exceeded six times the commonly used 5,000 MPN/100 ml general recreation objective. Ten percent of the samples from this station contained more than

62,000 MPN/100 ml, which is more than 12 times the objective.

In the interstate waters near the mouth of Back River (S-11.5-0.5) the average 10,300 MPN/100 ml total coliform density was twice the objective. Ten percent of the samples exceeded 22,000 MPN/100 ml, which is more than 4 times the objective.

The waters flowing past R.M. 10 in Georgia, towards the interstate waters one-half mile downstream, also exceeded the objective with an average of 7,250 MPN/100 ml and 10 percent of the samples contained more than 14,000 MPN/100 ml, or almost 3 times the 5,000 MPN/100 ml objective.

The average coliform densities at sampling stations in the interstate and intrastate reaches of the North Channel from below River Mile S-10.0 to the mouth were reduced below the 5,000 MPN/100 ml standard for general recreation. The 10 percent values, however, equalled or exceeded the objective in [illegible] of the 10 miles. Coliform bacteria in these waters contributed to pollution of the adjoining Wright and New rivers in South Carolina where total coliform densities exceeded the allowable limits for shellfishing.

The median total coliform density for approved shellfish harvesting areas should not exceed 70 MPN/100 ml, and a density of 230 MPN/100 ml should not be exceeded in more than 10 percent of the samples. These objectives for shellfish waters were exceeded throughout the entire reach of the Savannah River included in this study.

The bacterial quality of portions of the Wright and New rivers in South Carolina exceeded the 70 MPN/100 ml total coliform bacteria limiting objective for shellfishing. The median total coliform densities in the Wright River ranging from 175 MPN/100 ml 4-1/2 miles upstream to 380 MPN/100 ml at the mouth were from 2.5 to 5.5 times the objective for shellfishing. The total coliform densities at these stations exceeded 230 MPN/100 ml from 42 to 73 percent of the time.

In 4 of the 6 miles of the New River under study, the total coliform densities slightly exceeded the median objective as they ranged from 80 to 120 MNP/100 ml. The total coliform densities at all New River stations exceeded the 230 MPN/100 ml decile limit from 14 to 28 percent of the time.

Calculations based on data from dye studies of the U. S. Army Corps of Engineers Savannah Harbor Hydraulic Model indicate that about 99 percent of the sewage associated bacterial pollution in the main channel, and from 85 to 94 percent in the Wright River can be attributed to sewage from the city of Savannah. In the New River, from 57 to 86 percent are attributed to the city of Savannah, and 14 to 43 percent to the unchlorinated effluent from the Savannan Beach sewage treatment plant.

These bacterial densities, which include bacteria of fecal origin, indicate health hazards in the use of certain of these waters for recreation and shellfishing. Therefore the

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States of Georgia and South Carolina have closed much of this area to shellfishing.

Although neither Georgia nor South Carolina has established D.O. standards for the Savannah Estuary, in other classified waters in the State the South Carolina Water Pollution Control Authority has established 4.0 mg/l of dissolved oxygen as the minimum objective for the propagation of a well balanced population of fish and other desirable aquatic life.

The D.O. in the Savannah River was frequently [illegible] this 4.0 mg/l D.O. objective at all sampling stations in [illegible] entire 21-mile reach of intrastate and interstate [illegible] S-19 at the Chatham County industrial complex to [illegible] mouth of the river.

At S-5, in the interstate waters near Fields Cut, the D.O. averaged 2.8 mg/l and the minimum values ranged from 1.1 near the surface to 1.6 near the bottom. At this station, 78 percent of the samples contained less than 4.0 mg/l; 60 percent contained less than 3.0 mg/l and 21 percent contained less than 2.0 mg/l of D.O.

Oxygen-demanding pollution entering the river in Georgia reduced the dissolved oxygen levels of waters in Georgia and South Carolina below the generally accepted water quality objectives for the propagation of fish and other desirable forms of aquatic life.

Sewage and industrial wastes discharged to the [illegible]

River Estuary from Georgia cause pollution of interstate waters in Savannah River Estuary, which endangers the health or welfare of persons in South Carolina, and therefore is subject to abatement under the provisions of the Federal Water Pollution Control Act.

Introduction:

On the basis of reports, surveys, or studies, having reason to believe that pollution of the Savannah River Estuary originating in Georgia was endangering the health or welfare of persons in South Carolina, the Secretary of the Department of Health, Education, and Welfare called a conference of the state water pollution control agencies of Georgia and South Carolina, and the Department of Health, Education, and Welfare.

This report on pollution of interstate waters of the Savannah River Estuary is based primarily on data obtained by the Department through a field study conducted during the period August 6 through August 27, 1963. The Chatham County Health Department performed the bacteriological examinations on samples collected during this survey.

The manner in which wastes are dispersed throughout the esturay by the undulating flood and ebb tides was determined from Savannah Harbor Hydraulic Model studies conducted by the U. S. Army Engineer Waterways Experiment Station at Vicksburg, Mississippi.

Supplementary information was provided by the Georgia State Department of Public Health, South Carolina Water Pollution Control Authority, Chatham County Health Department, City of Savannah, and representatives of industries and municipalities.

Data obtained during the October 21 - November 9, 1962 preliminary survey was used to select appropriate sampling stations, determine sampling period intervals, and organize the field study of this complex tidal estuary.

The whole-hearted and invaluable cooperation of the numerous agencies and individuals is gratefully acknowledged.

The Area:

The Savannah River is one of the principal interstate streams of the southeastern states. Formed by the Tugaloo and Seneca rivers, and impounded in the Hartwell and Clark Hill reservoirs in northern Georgia and South Carolina, the river flows past Augusta, Georgia, and the Savannah River plant of the Atomic Energy Commission and continues southeasterly on its way out to the sea below Savannah, Georgia. It forms the boundary between Georgia and South Carolina for approximately 310 miles.

The study area covered by this report (Figure 1) includes the lower 28 miles in the States of Georgia and South Carolina, and the connecting Wright, New and Cooper rivers in the State of South Carolina. The uppermost sampling station is located at River Mile (R.M.) S-28, about seven river miles upstream from the northern limits of the 5-mile Chatham County industrial complex, which extends from about R.M. 21 down to R.M. 16. The river flows past the center of the city of Savannah near R.M. 14.5, and then branches off into North and South Channels at R.M. 10.0. At a point about 5 miles above the mouth, the intercoastal waterway connecting the Wright, New and Cooper rivers branches off from the North Channel through Fields Cut. Rock jetties define the North Channel for about 2 miles out into the ocean from the Fort Pulaski National Monument, which is designated as R.M. 0.

The Front River channel of the Savannah River bordering the city of Savannah, Georgia, is located in the State of Georgia. In this region, Back River forms the interstate boundary to a point just above its confluence with Front River. From this point, the State boundary follows the cut north of Barnwell Island for about 2 miles, and then the center of the North Channel of the Savannah River for about 7 miles to Horseshoe Shoals, where it veers to the east and out into the Atlantic Ocean.

The Savannah River is the nucleus for economic, commercial industrial, and community activity and growth of the city of Savannah and Chatham County.

The City of Savannah, Georgia with a population of about 150,000 is by far the largest community in the area. Savannah Beach, Georgia, a resort area located along the ocean front southeast of the river mouth, attracts an estimated 25,000

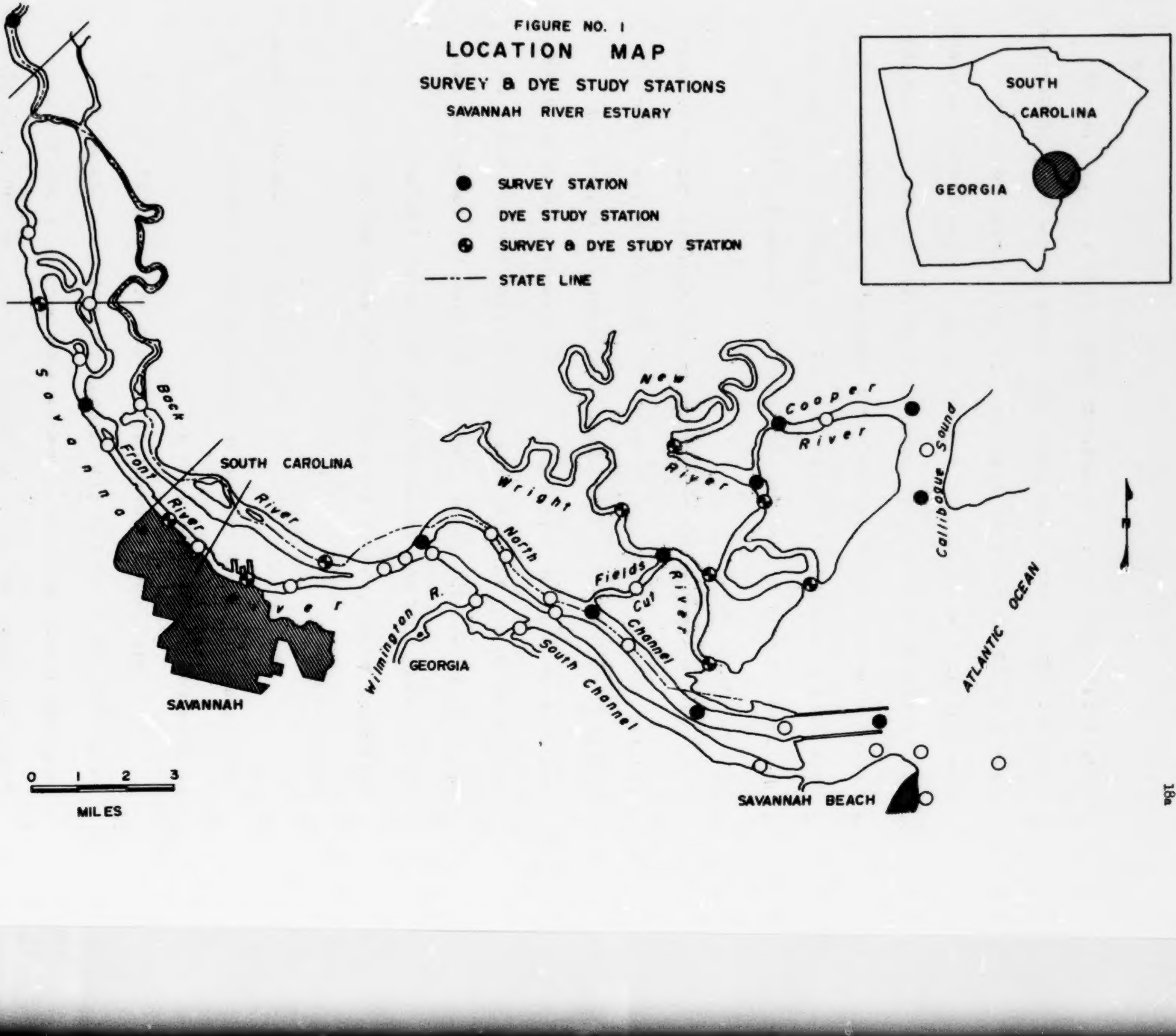

FIGURE NO. 1
LOCATION MAP
SURVEY & DYE STUDY STATIONS
SAVANNAH RIVER ESTUARY

● SURVEY STATION
○ DYE STUDY STATION
⊕ SURVEY & DYE STUDY STATION
—·— STATE LINE
SOUTH CAROLINA
GEORGIA
Savannah River
Back River
Front River
South Carolina
Savannah
Wright River
New River
Cooper River
Calibogue Sound
North River
Fields Cut
Channel
Wilmington R.
Georgia
South Channel
Atlantic Ocean
Savannah Beach
0 1 2 3
MILES

population during the recreational period of the year. Other Georgia communuties, including Chatham City, Garden City, and Port Wentworth, adjoin the river.

Industries located in the area include pulp and paper mills, a sugar refinery, asphalt roofing and pressure creosoting plants, marine terminals for asphalt and flammable petroleum products, and plants producing naval stores, fertilizers and chemical products.

Water Uses:

The main channels of the Savannah River in the study area are used principally for navigation, commerce, boating, industrial water supply, and waste disposal. In former years, the river and adjacent waters were used for commercial fishing and shellfish harvesting. The waters off the main channel and along the ocean front are used extensively for recreational boating, fishing, swimming, and water skiing.

Industrial Water Supply:

Savannah River water in the study area is used extensively as a source of industrial cooling water. The total amount used for this purpose is estimated to exceed 50,000,000 gallons per day. In addition to water obtained from other sources, Union Bag-Camp, Continental Can, Savannah Sugar Refining, and American Cyanamid plants each use about 10,000,000 gallons of river water per day.

Navigation:

Ocean going vessels, engaged in world commerce, navigate the Savannah River on their way to and from the city of Savannah and the industrial area in Chatham County. The U. S. Army Corps of Engineers operates dredges and work boats on the river during their continuing program of river channel maintenance. Smaller craft cruise the river and connecting streams in the intercoastal waterway. These boating activities involve contact of individuals with the water in the estuary.

Commercial Fishing:

At one time commercial fishermen fished the Savannah River extensively for the American shad. It is reported that in recent years the flesh of the fish caught in this area was tainted with objectionable tastes and commercial buyers were reluctant to handle Savannah River fish. The commercial fishermen gradually moved to other fishing areas and the Savannah River no longer supports a commercial shad fishery.

Oysters abound in the tidal waters of the Savannah River Estuary. Some 30 years ago, this area supported a commercial shellfishing industry. Parts of the Savannah River and adjacent tidal waters are polluted by sewage, and because of the health hazard associated with the consumption of raw oysters harvested from waters containing bacteria from sewage pollution, these areas in Georgia and South Carolina have been closed to shellfishing by the State health departments, and this commercial fishery no longer exists.

The waters of the sound outside the mouth of the river fished extensively for shrimp and commercial trawlers continue to traverse the sound while engaged in this industry.

Recreation:

The tidal waters of the Savannah River are used for sport fishing and recreational boating, and areas of the connecting streams and the ocean front beaches, principally in Georgia, are used for water contact sports such as swimming and water skiing. Hundreds of boats, moored in these areas, cruise these waters on the way out to the deep sea fishing areas in the Atlantic Ocean.

Sources of Wastes;

Raw and partially treated sewage and industrial wastes cause excessive pollution of certain reaches of the Savannah River in Georgia and South Carolina. The sewage discharges also cause excessive bacterial pollution of certain reaches of the Wright River and the New River in South Carolina.

Sewage:

Sewage contains numerous obnoxious constituents which may have adverse effects on water quality and uses. The effects of sewage pollution on the Savannah River Estuary have been evaluated primarily on the basis of bacteria and oxygen demanding materials. The content of sewage from either untreated or treated sources may be described in terms of bacterial and oxygen demand population equivalents. The population equivalents are the sewered populations that would produce raw sewage having equivalent quantities of bacteria or oxygen demanding substances.

All of the known sewage discharges enter the tidal waters from Savannah, Georgia, metropolitan area and Savannah Beach. The estimated sewage characteristics, shown in Table 1, are based on information provided by representatives of the City of Savannah and the Chatham County Health Department. The total sewered population is estimated to be 194,000. Approximately 25 percent of this total sewered population is located in areas that are drained toward the intrastate Vernon, Wilmington, and Little Ogeechee rivers in the State of Georgia. Raw and treated sewage from the remaining 75 percent of the sewered population discharges to the Savannah River, which flows along the interstate boundary between Georgia and South Carolina below River Mile 10, and is connected to the Wright and New rivers in South Carolina. This 75 percent includes the treated sewage from Savannah Beach, which is discharged to the Georgia waters of the Ocean near the mouth of South Channel and which, in turn, is distributed throughout both Georgia and South Carolina waters by tidal currents.

The sewage from that quarter of the total sewered population which discharges into the Georgia intrastate waters receives secondary treatment, with the exception of an undetermined portion of the raw sewage which is discharged directly to the Wilmington River from Thunderbolt. Two jurisdictions, Bacon Park

Table No. 1

ESTIMATED SEWAGE CHARACTERISTICS

August, 1963 Survey
Savannah River Estuary

Jurisdiction	Receiving Stream	Type of System*	Type of Treatment	Population Served	Population Equivalents Discharged			
					Oxygen Demand		Bacteria	
					Number	% of Total	Number	% of Total
I. Discharges Entering Savannah River or Canals Flowing to the Savannah River								
Port Wentworth Corp.	Savannah River (From S-21 to S-20)	S	None	3,700	3,700	2.7	3,700	2.8
Travis Field	Pipemakers Canal (Entering River at S-18.5)	S	Primary (Imhoff Tank)	970	640	0.5	480	0.4
Garden City (Untreated Part)	Pipemakers Canal (Entering River at S-18.5)	S	None	5,200	5,200	3.8	5,200	4.0
Chatham City (Treated Garden City Area)	Dundee Canal (Entering River at S-17.4)	S	Primary	1,800	1,200	0.9	900	0.7
Ruberoid Co. (Domestic Sewage)	Dundee Canal (Entering River at S-17.4)	S	Primary (Spiragester)	180	120	0.1	90	0.1
City of Savannah (Untreated Part)	Savannah River (From S-16 to S-13)	C	None	108,000	108,000	79.6	108,000	82.4
Cloverdale	Springfield-Savannah-Ogeechee Canal (Entering at S-15)	S	Secondary (Oxidation Pond)	1,500	150	0.1	150	0.1
Atlantic Cement (Domestic Sewage)	Back River (at RM-15)	S	Secondary (Cavitette)	15	0+	0	0+	0
Savannah Beach (Summer Population)	Mouth of South Channel	C	Primary (Sed. & Digestion)	25,000	16,700	12.3	12,500	9.5
	Total to Savannah River			146,365	135,710	100.0	131,020	100.0

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Table No. 1
Cont.

[illegible]

August, 1963 Survey
Savannah River Estuary

Jurisdiction	Receiving Stream	Type of System*	Type of Treatment	Population Served	Oxygen Demand Number	Oxygen Demand % of Total	Bacteria Number	Bacteria % of Total
II. Discharges to Tributaries of the Savannah River								
Bacon Park	[illegible] River	S	Secondary & Chlorination	38,000	11,400	88.1	380	40.0
Wilshire Estates	Vernon River	S	Secondary (Oxidation Pond)	1,500	150	1.2	150	15.8
Hunter Air Force Base	Little Ogeechee R.	S	Secondary & Chlorination	5,000	1,000	7.8	50	5.3
Windsor Forest	Little Ogeechee R.	S	Secondary (Oxidation Pond)	3,500	350	2.7	350	36.8
Thunderbolt	Land & Wilmington R.	-	Septic Tanks & Drain Fields (Some Direct to River)	Undet.	-	-	-	-
Islandwood	Wilmington R.	S	Secondary (Oxidation Pond)	200	20	0.2	20	2.1
Total to Tributaries				48,200	12,920	100.0	950	100.0

* Type of System: S = Separate Sanitary Sewers

C = Combined Sanitary & Storm Sewers

and Hunter Air Force Base, chlorinate the treated sewage.

Approximately one-fifth of the sewage from that three-quarters of the total sewered population which discharges to the Savannah River receives primary treatment. The areas served by these plants include Savannah Beach, Chatham City, and Travis Field. Sewage from Cloverdale, amounting to approximately 1 percent of the total flow reaching the Savannah River, receives secondary treatment.

Properly designed and operated primary sewage treatment plants can remove approximately one-third of the oxygen-demanding materials, and about one-half of the bacteria from raw sewage. Secondary sewage treatment plants, which are essentially biological processes, can remove approximately 90 percent of the oxygen-consuming material, and 90 to 99 percent of the bacteria from raw sewage. Chrlorination of treatment plant effluents can achieve further major reductions in the bacterial content of the sewage, but accomplishes little additional reduction in other constituents. The combination of secondary biological treatment and chlorination can accomplish the maximum reduction of all pollutional constitutents that are feasible by present conventional sewage treatment methods, but in no case is 100 percent removal effected. Some residual materials remain in effluents from even the most efficient types of treatment facilities.

Bacteria:

The estimated characteristics of sewage from the entire Savannah Beach and city of Savannah metropolitan area are shown in Table 1. The following discussions of bacteria and oxygen demand of the sewage, and subsequently of industrial wastes, cover only those portions of the wastes that enter the Savannah River or South Channel, and which are in turn carried into the interstate South Carolina waters.

The total sewered population of the area draining toward the interstate waters is estimated to be 146,000. The treatment presently provided is estimated to reduce the overall bacterial content of the sewage by about 10 percent, leaving bacteria equivalent to those in the raw sewage from 131,000 persons to enter the waters.

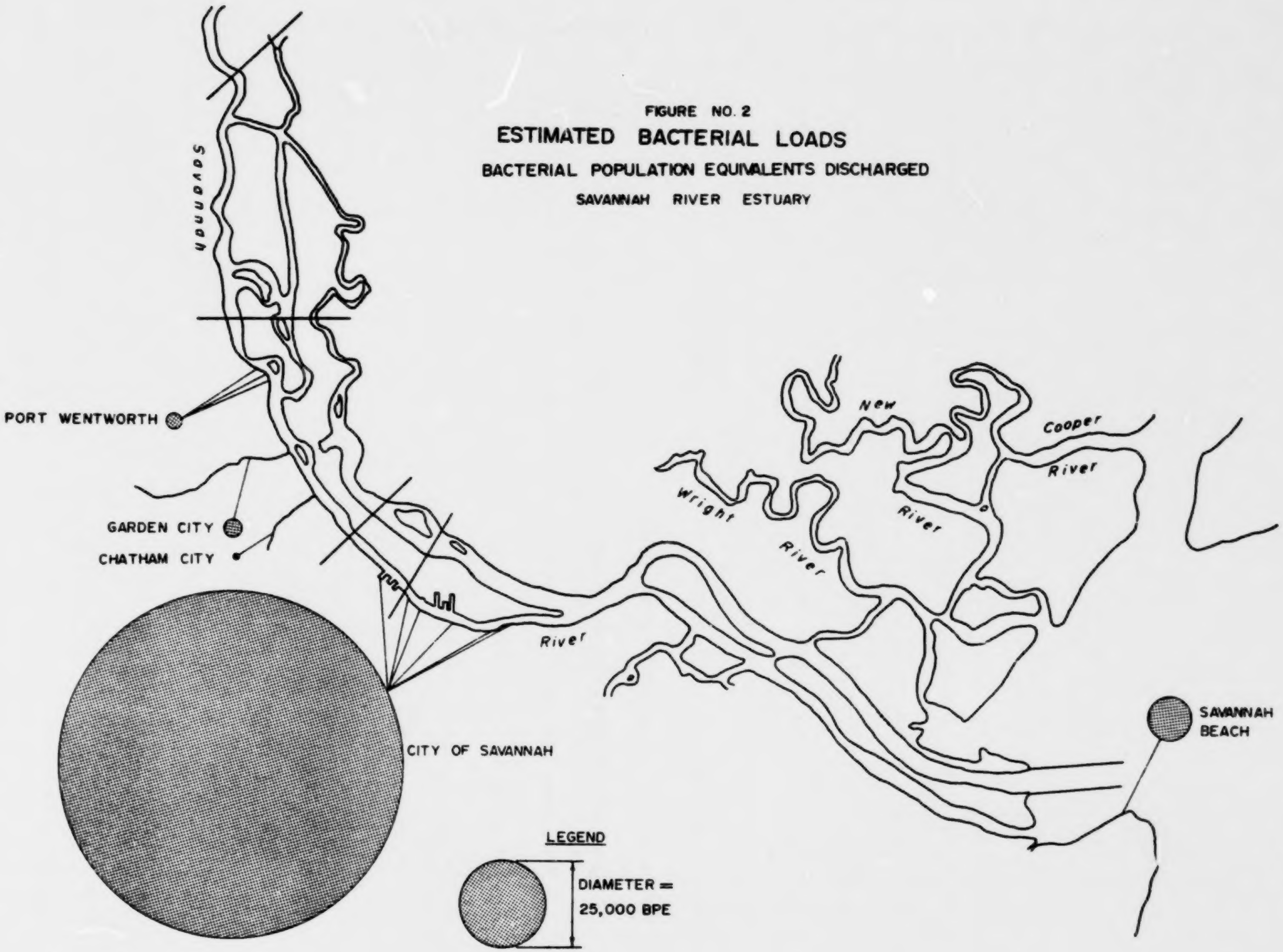
The estimated bacterial loads from the various source of sewage, with estimated allowances for any treatment provided are presented in Section I of Table 1. The loads are expressed in terms of bacterial population equivalents (BPE). A bacterial population equivalent may be defined as the quantity of coliform bacteria contributed to a stream daily by the untreated sewage discharge from one person. The data in Section I of Table 1 are shown graphically in Figure 2. This figure provides a visual impression of the relative proportion of the total bacterial load discharged from each known source of sewage. The diameters of the circles are in proportion to the loads from the various jurisdictions. The circle in the legend, representing the scale

FIGURE NO. 2

ESTIMATED BACTERIAL LOADS

BACTERIAL POPULATION EQUIVALENTS DISCHARGED

SAVANNAH RIVER ESTUARY


Savannah
River
PORT WENTWORTH
GARDEN CITY
CHATHAM CITY
CITY OF SAVANNAH
Wright River
New River
Cooper River
SAVANNAH BEACH
LEGEND
DIAMETER = 25,000 BPE

of the drawing, is equivalent to the bacterial contribution of raw sewage from 25,000 persons.

The untreated portion of the raw sewage from the city of Savannah, entering the Savannah River between River Mile S-16 and S-13, is the largest source of bacterial pollution. The 108,000 estimated population equivalent from this source amounts to approximately 80 percent, or more than three-quarters of the total from all sources.

Savannah Beach, providing inadequate primary sewage treatment for an estimated 25,000 summer population, is the second single largest source. Raw sewage is periodically bypassed around the treatment plant and breaks in the outfall sewer release sewage directly on the shore instead of diffusing all wastes into the deeper waters. Sewage is not chlorinated or otherwise disinfected. It is estimated that the effluent from this primary sewage treatment plant, discharged near the mouth of South Channel, contains approximately 12,500 bacterial population equivalents, or 10 percent of the total from all sources.

All other discharges combined, including approximately 3 percent from Port Wentworth Corporation, 4 percent from the untreated portion of Garden City sewage, and the other smaller sources listed in the table but not illustrated on the drawing, amount to 8 percent of the total bacterial load.

Oxygen Demand:

The raw sewage from all sources is estimated to exert a 5-day biochemical oxygen demand (BOD) equal to a population equivalent (PE) of 146,000. The treatment provided reduces the combined oxygen demand only 7 percent, leaving a PE of 136,000, or 93 percent of the total, to be discharged to the receiving streams.

Of the oxygen demand from sewage sources, approximately 80 percent is accounted for by the raw sewage from the city of Savannah, and 12 percent by the effluent from the Savannah Beach primary sewage treatment plant. The other jurisdictions shown in Part I of Table 1, and including Port Wentworth Corporation and Garden City, are responsible for the remaining 8 percent of the total oxygen demand load.

Industrial Wastes:

The industrial wastes discharged to the Savannah Estuary add little to the total bacterial pollution of the waters. Domestic sewage is discharged without treatment at some of the plants, but most of the employees live in nearby sewered areas, and the bacterial population equivalents of sewage from these sources are included in the preceding discussion of bacterial pollution from sewage sources. The Rubberoid Company provides primary, and the Atlantic Cement Company provides secondary treatment for domestic sewage from these plants which employ a total of approximately 200 people.

This section of the report covers the pollutional effect of oxygen-demanding materials discharged to the river.

Information concerning industrial waste characteristics was provided by representatives of the industries located in the Savannah Harbor area. The estimated industrial wastes characteristics of the eight industries discharging oxygen-demanding materials to the river are shown in Table 2. A table showing the amount and nature of wastes from other industries discharging cooling water or industrial wastes, but not containing significantly to the oxygen demand of the river, is shown in Table 3. The location of marine terminals storing inflammable and asphalt products is shown in Table 4.

Oxygen Demand:

The industrial wastes of the study area have a total estimated PE of 1,000,000. The relative sizes of the individual oxygen demanding loads from industry are shown on Table 5.

The waste discharge from Union Bag-Camp Paper Corporation, located at R.M. S-16.6 just north of the Savannah city limits, is the largest single source of oxygen-demanding pollution. This kraft pulp and paper mill, producing from 2600 to 2700 tons of air-dried pulp per day, and employing about 5200 persons, is one of the largest plants of its type in the world. Principal products are kraft pulp, unbleached paper and paperboard, crude sulfate tall oil, and turpentine. Waste control consists generally of white water re-use and save-alls for fiber recovery in the paper mill, and clarifiers for removal and recovery of floatable

Table No. 2

ESTIMATED INDUSTRIAL WASTE CHARACTERISTICS
(Oxygen Demand of Wastes Discharged to the River)

August, 1963 Survey
Savannah River Estuary

Plant	Classification	Receiving Stream	River Mile	Type of Treatment	Oxygen Demand Population Equivalents Discharged Number	% of Total
Continental Can Co., Inc.	Paper Mill	Savannah River	20.9	Save-all	130,200	12.7
Savannah Sugar Refinery Corp.	Sugar Refining	Savannah River	19.8	None	30,000	2.9
The Ruberoid Company	Asphalt Roofing & Felt	Dundee Canal to River	17.4	Save-alls	4,500	0.4
Hercules Powder Company	Naval Stores & Tall Oil	Dundee Canal to River	17.4	Skimmer	3,900	0.4
Certain-Teed Product Corp.	Asphalt Roofing & Felt	Savannah River	17.3	None	24,000	2.3
Union Bag-Camp Paper Corp.	Paper Mill	Savannah River	16.6	Save-all & Skimmer	810,000	78.6
Wesson Division, Hunt Food & Industry, Inc.	Food Products	Savannah River	16.2	Oil Separators	26,000	2.5
Meddin Packing Company	Packinghouse	Savannah & Ogeechee Canal to River	15.0	None	1,740	0.2
Total to Savannah River					1,030,340	100.0

Table No.3

Industries Discharging Cooling Water or Industrial Wastes, But Not Contributing Significantly to the Oxygen Demand of the River
August, 1963 Survey
Savannah River Estuary

Plant & Classification	Stream & River Mile	Nature of Discharge	Flow MGD
Atlantic Creosoting Co. Pressure Creosoting	Savannah River at S-19.9	2,970 ppb phenol (1.21 lbs/day	0.05
Southern Nitrogen Co., Inc. Synthetic Nitrogen	Swamp leading to the Savannah River at S-19.4	3 lbs. NH_4NO_3/day	
General Chemical Div. Allied Chemical Corp. Liquid Alum	Pipemakers Canal (Entering River at S-18.5)	Equipment washing (Waste mud is ponded)	0.002
American Agricultural Chem. Superphosphate	Dundee Canal (Entering River at S-17.4)	Cooling water	
American Oil Co. Asphalt Roofing	Savannah River at S-17.1	Approx. 57 ppb phenol Approx. 7 ppm oil	3.9
Johns-Manville Products Corp. Asphalt Roofing	Savannah River at S-17	Settled cooling water	0.29
Virginia-Carolina Chem. Corp. Superphosphate	Savannah River at S-16.2	Est. 750 lbs/day of F_2	0.11
Southern Fertilizer & Chemical Co. Superphosphate	Savannah River at S-14.5	Cooling water	
Southern States Phosphate & Fert.Co. Superphosphate	Savannah River at S-13	Cooling water	
American Cyanamid Co. Titanium Dioxide	Savannah River at S-10.5	690,000 lbs/day of H_2SO_4 to ponds for controlled disch.	5.0

Table No. 4

LOCATION OF MARINE TERMINALS
August, 1963 Survey
Savannah River Estuary

Industry & Classification	Receiving Stream	River Mile
Inflammable Products		
Southern Oil Co.	Savannah River	17.7
American Oil Co.	Savannah River	17.1
Colonial Oil Co.	Savannah River	15.7
Gulf Oil Corp.	Savannah River	14.6
Atlantic Refining Co.	Savannah River	11.7
The Pure Oil Co.	Savannah River	11.6
Standard Oil Co.	Savannah River	11.5
Asphalt		
American Bitumils & Asphalt Co.	Savannah River	19.4
Savannah Terminal	Savannah River	17.7

Table No. 5

ESTIMATED OXYGEN DEMAND
Industrial Wastes and Sewage

August, 1963 Survey
Savannah River Estuary

Source	Type	Population Equivalents Number	 % of Total
Continental Can Co., Inc.	Ind. Waste	130,200	11.1
Port Wentworth Corp.	Sewage	3,700	0.3
Savannah Sugar Ref. Corp.	Ind. Waste	30,000	2.6
Garden City	Sewage	5,200	0.4
Travis Field	Sewage	640	0.1
Ruberoid Co.	Ind. Waste	4,500	0.4
Hercules Powder Co.	Ind. Waste	3,900	0.3
Chatham City	Sewage	1,200	0.1
Certain-Teed Products Corp.	Ind. Waste	24,000	2.1
Union Bag-Camp Paper Corp.	Ind. Waste	810,000	69.5
City of Savannah	Sewage	108,000	9.3
Wesson Div., Hunt Food & Industry, Inc.	Ind. Waste	26,000	2.2
Meddin Packing Co.	Ind. Waste	1,740	0.2
Cloverdale	Sewage	150	-
Savannah Beach	Sewage	16,700	1.4
Total		1,165,930	100.0

waste oils from the tall oil operation. Domestic sewage from plant employees enters the process lines, and seven separate outfalls discharge wastes to the river. The industrial wastes from this plant, with a total estimated population equivalent of 810,000,comprised 79 percent of the total industrial waste loading.

The Continental Can Company, Inc., located at R.M. S-20.9, is the second largest source of industrial wastes. This company, employing about 565 people, produces from 575 to 600 tons of air-dried pulp per day, and the principal product is unbleached kraft liner board. Waste control consists of white re-use and save-alls for fiber recovery. Sanitary sewage from plant employees enters the process sewers. The population equivalent of the industrial wastes entering the river through two sewers is estimated to be 130,000 or 13 percent of the total industrial waste loading.

Industries discharging industrial wastes with estimated population equivalents in the range of 24,000 to 30,000 each include the Savannah Sugar Refining Corporation at R.M. S-19.8, the Certain-Teed Products Corporation at R.M. S-17.3, and the Wesson Division of Hunt Food and Industry, Inc., at R.M. S-16.2

Waste discharges from the Ruberoid Company, the Hercules Powder Company, and the Meddin Packing Company, are estimated to range from 1700 to 4500 population equivalents.

Oxygen-Demanding Wastes - Total from Sewage and Industrial Wastes:

The relative sizes of the oxygen-demanding waste loads from each of the individual sources of sewage and industrial wastes loads are posted in Table 5 and shown in Figure 3. Of the total, approximately 1,000,000 PE, or 88.5 percent, was discharged by industries, and approximately 136,000 PE, or 11.5 percent of the load, was domestic sewage. The diameters of the shaded circles represent relative loads from industrial waste sources, and the diameters of the solid circles show the relative loads from sewage sources. The circle in the legend, representing the scale of the drawing, is equivalent to a 200,000 population oxygen-demanding load.

Almost 70 percent of the total load was discharged by Union Bag-Camp, approximately 11 percent of the total was discharged by the Continental Can Company, and about 9 percent was in the form of untreated raw sewage from the city of Savannah. Smaller loads, ranging from about 1.5 to 2.5 percent each, were discharged by the Savannah Sugar Refining Corporation, Certain-Teed Products Corporation, and the Savannah Beach primary sewage treatment plant. Industries and municipal jurisdictions discharging less than 1 percent of the total load each are tabulated in the preceding tables, but are not shown on this figure.

Acid Wastes:

The American Cyanamid Company titanium dioxide plant, located at R.M. S-10.5, discharges an estimated 690,000 pounds of sulfuric acid into the river each day during ebb tide.

Analysis of the samples collected from the river during the August, 1963 survey indicates that additional acid wastes reached the river from above R.M. 16, north of the city of Savannah. The source of the waste which caused this increase in the acid content of the river has not been determined.

Dispersion of Wastes:

The U. S. Army Waterways Experiment Station, in Vicksburg, Mississippi, ran tests on the Savannah Harbor Hydraulic Model to determine the dispersion characteristics of waste discharges from major sources of pollution in the Savannah Harbor, and to supplement the data collected during the on-site field study. Test results, including a description of the dye releases and the residual dye concentrations observed throughou the Model, were reported by the Waterways Experiment Station.* The test data were processed, analyzed, and interpreted by the Public Health Service.

Model Test Conditions:

All tests were performed under normal conditions of mean tide, with a normal fresh water discharge of 7,000 cfs and an ocean salinity of 30 parts per thousand. Measured dye solutions were released into the Model at the location of known

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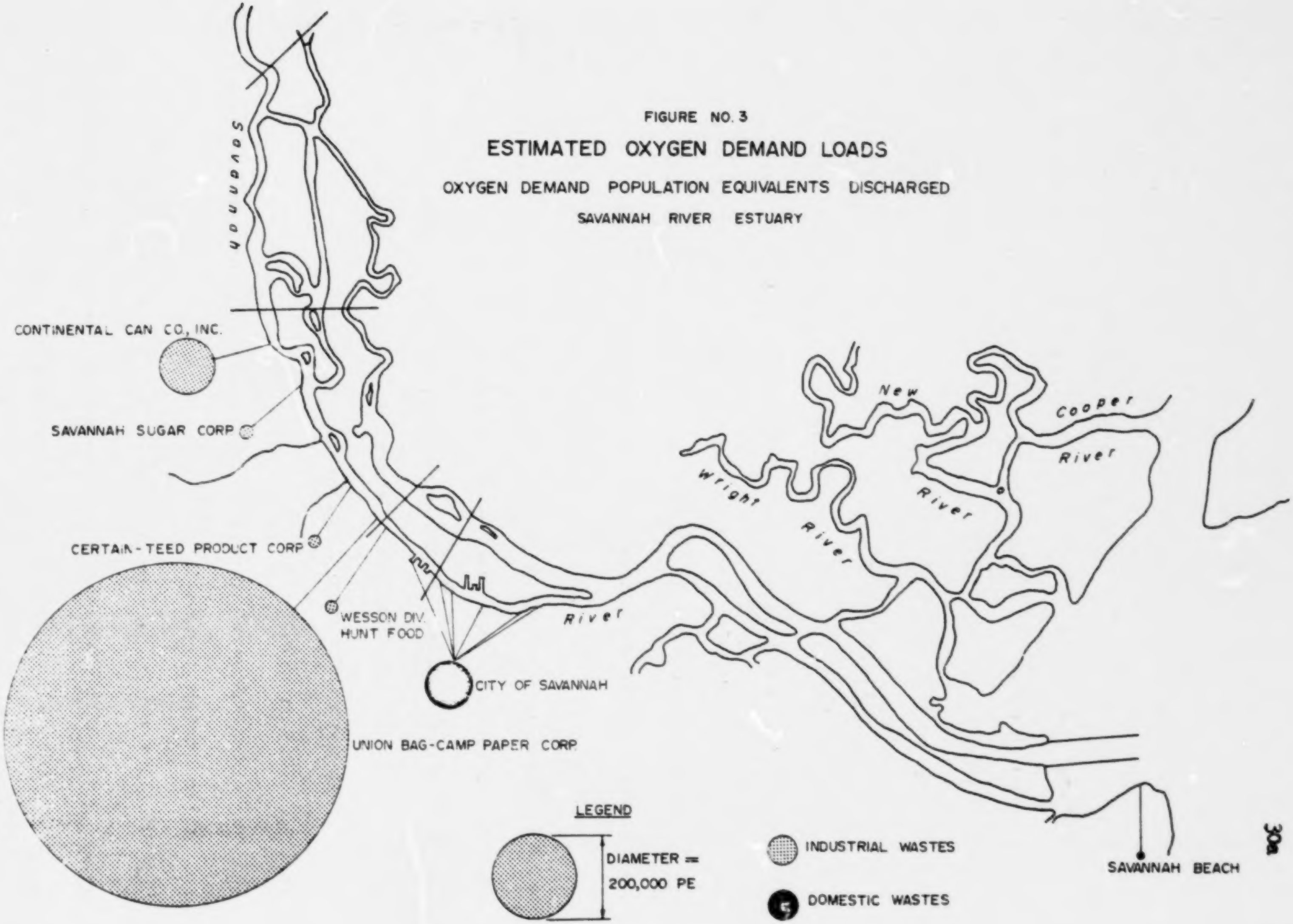
*Pollution Studies, Savannah Harbor, Hydraulic Model Investigation, U. S. Army Engineer Waterways Experiment Station, Corps of Engineers, Vicksburg, Mississippi, Miscellaneous Paper No. 2-633, March, 1964.

FIGURE NO. 3

ESTIMATED OXYGEN DEMAND LOADS

OXYGEN DEMAND POPULATION EQUIVALENTS DISCHARGED

SAVANNAH RIVER ESTUARY


Savannah
River
CONTINENTAL CAN CO., INC.
SAVANNAH SUGAR CORP
CERTAIN-TEED PRODUCT CORP
WESSON DIV. HUNT FOOD
CITY OF SAVANNAH
UNION BAG-CAMP PAPER CORP
Wright River
New River
Cooper River
SAVANNAH BEACH
LEGEND
DIAMETER = 200,000 PE
INDUSTRIAL WASTES
DOMESTIC WASTES

sources of pollution and residual dye concentrations were determined throughout the Model at periods of both high and low water slack during each of 80 successive tidal cycles. The dispersion patterns of the dye used in the Model to simulate pollution were confirmed by the results of dye studies in the Savannah Estuary during the November, 1962 preliminary survey. Actual mean daily fresh water discharges, measured by the USGS gage at Clyo, Georgia, averaged 7180 cfs during the November 1962 preliminary survey and 9170 cfs during the August, 1963 survey.

Time of Travel and Dilution Ratios:

The estimated minimum times of travel and dilution ratios, calculated from instantaneous dye releases, at high water slack and at low water slack, in the Model at the city of Savannah location are summarized in the following table:

	Dye Release at High Water Slack	Dye Release at Low Water Slack
Minimum time to reach:		
Ocean at jetties	30 hours	72 hours
Mouth of Wright River	30 hours	72 hours
Station 12-9 Wright River	60 hours	96 hours
Mouth of New River	30 hours	72 hours
Station 10-10 New River	60 hours	96 hours
Dilution* ratio in:		
Ocean at jetties	4.6: 1	8.3: 1
Mouth of Wright River	23 : 1	40 : 1
Station 12-9 Wright River	29 : 1	48 : 1
Mouth of New River	32 : 1	58 : 1

*Dilution from the maximum concentration in the river near the outfall. (Stations shown on Fig. C.)

Dye Dispersion and Path of Travel:

Dyes Released at the City of Savannah Location.

Dyes released into the Model in the vicinity of the city of Savannah, simulating sewage and industrial waste discharges, undulated up and down the channel in response to flood and ebb currents, with a generalized net downstream movement. Approximately 70 percent travelled down the North Channel, and 30 percent down the South Channel. Of this total, approximately 5 percent entered the Wilmington River, 3 percent reached Savannah Beach, 1 percent entered the Wright River, and 1 percent entered the New River. Fields Cut, rather than the Ocean, was the predominant path of dye flow into the Wright and the New Rivers. An extremely small amount of dye reached Calibogue Sound. About 90 percent of the dye remained in the predominantly South Carolina interstate waters between Savannah and Calibogue Sound, and gradually mixed into the Ocean.

Dyes Released at the Savannah Beach Location:

About 10 percent of the dye released from the Savannah Beach sewage treatment plant outfall sewer location remained near Savannah Beach. Tidal currents carried somewhat less than 5 percent up the North Channel as far as Fields Cut. About 1 percent entered the Wright River, 1 percent entered the New River, and another 1 percent or less entered Calibogue Sound. Approximately 80 percent of the dye remained in the predominantly South Carolina interstate waters between Savannah Beach and Calibogue Sound, and gradually mixed into the Ocean.

Probable Influence of the Channel Improvement Plan Proposed by the U. S. Army Corps of Engineers:

During one set of tests, the physical features of the model were changed to simulate the proposed 38 ft. deep x 500 ft. wide channel in Front River and the sediment basin in Back River as proposed by the U. S. Army Engineers. Comparison of the dye data for the existing and proposed channel condition shows that, while there is some generalized movement of the dye downstream, there is no significant difference in the circulation of the dye outside of the North Channel. The dye data indicate that the proposed channel improvement plan will not significantly alter the effects of pollution on the tidal waters.

Effects of Pollution on Water Quality and Use:

Excessive bacterial pollution of a stream or estuary presents a health hazard to those who come in contact with the water, or consume raw shellfish harvested from polluted waters. Excessive oxygen demand reduces the dissolved oxygen of the water, which results in reduction or destruction of fish and desirable aquatic life.

During the August, 1963, field study, total coliform, fecal coliform, dissolved oxygen (D.O.), pH, and temperature data were collected at 2-hour intervals throughout a complete 12-hour tidal cycle at the sampling stations shown on Fig.1. Three sampling runs of this type were made at most stations. Bacteriological samples were collected near the surface in the center channel. Separate dissolved oxygen, temperature and pH samples were collected near the top, mid-depth, and bottom of the center channel of the Savannah River and North Channel at approximately 5, 15, and 28 ft. depths. D. O. Samples were not collected from the adjacent Wright, New or Cooper Rivers.

The data collected during the study to measure the effects of pollution are summarized in the Appendix. Table A is a list of sampling stations. Tables B, C and D include summaries of the total coliform and fecal coliform data and the calculated proportional effect of sewage from Savannah Beach and the city of Savannah. The D.O. summary is shown in Table E, and Tables F and G contain summaries of temperature and pH determinations.

Bacterial Pollution:

Municipal sewage contains enormous numbers of bacteria among which there usually are pathogenic bacteria, derived from human excreta, than can cause gastrointestinal diseases such as typhoid fever, diarrhea, and dysentery. These pathogenic bacteria, present in densities too low to be detected by available laboratory methods, can cause illness in persons who swallow water containing them. Oysters and other shellfish accumulate bacteria, in addition to other material, in their bodies and shell liquors as they filter the surrounding water in the process of feeding and respiration. Shellfish in waters polluted by sewage discharges can also accumulate pathogenic bacteria and viruses, such as those producing infectious hepatitis and polio. Although the bacteria and viruses do not normally harm the oyster, they can cause illness in persons who consume raw oysters harvested from waters containing them. As the densities of pathogenic bacteria are reduced by sewage treatment, dilution or forces of natural purification, the hazards of contracting diseases are proportionately reduced.

Sewage also contains bacteria of the coliform group which typically occur in excreta, or feces, and can readily be detected even at low densities. These bacteria, harmless in themselves, are determined in stream studies involving sewage pollution as indicators of the probable presence of pathogenic bacteria. In the absence of adequate methods for detection of other pathogenic organisms, such as viruses, in rivers or estuaries, coliform bacteria also serve as indicators of the probable presence of these organisms.

For many years the laboratory method for determination of the coliform group has been a principal tool used by sanitary engineers in evaluating bacterial pollution of surface waters. The coliform group has been used by numerous State and interstate water pollution control agencies as a basis for water quality objectives for various water uses. Unfortunately, the coliform group includes several types of bacteria which may come from sources other than excreta, and coliform data sometimes have been challenged because of this. In the last few years a method for specific detection of fecal coliform bacteria only has been developed. Although the method has the decided advantage of specificity, it has not been in use long enough to serve as a basis for quantitative water quality objectives.

Both methods of bacterial measurement were applied to all samples in this study.

The results of both determinations are expressed in terms of most probable numbers, or MPN, per 100 milliliters (ml) of water. One hundred ml is a little less than one-half cup. The coliform group usually is designated as total coliforms.

Neither Georgia nor South Carolina has adopted total coliform objectives of water quality for water contact sports, such as swimming and water skiing, or for general recreational use, such as boating and fishing, for the Savannah River Estuary.

Where such objectives have been adopted, the commonly used limit for water contact sports is 1,000 per 100 milliliters (ml) of water. This swimming water standard is used by South Carolina in other classified waters of the State.

Where total coliform objectives for general recreational use have been adopted, an arithmetic average of 5,000 MPN per 100 milliliters (ml) is the commonly used upper limit. It has been stated that the Savannah is a working river, and the U. S. Army Corps of Engineers alone reports that more than 100 persons in their organization work on the river. Exposure to the Savannah River waters, by work crews handling lines and equipment submersed in the waters, and travelling the rivers in small as well as large boats, is similar in many respects to the exposure for fishing and recreational boating, and the same coliform water quality objective of 5,000 per 100 ml could logically apply.

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Both states prohibit direct harvesting of shellfish for human consumption from waters polluted by sewage. The suitability of tidal waters for shellfish harvesting is based on the results of sanitary surveys and bacterial analysis of the waters. Waters subject to sewage pollution are closed to shellfishing by Georgia and South Carolina State Health Departments, where sanitary surveys indicate that sewage may reach the waters, or where the median total coliform MPN value representative of the waters of the shellfish growing areas exceeds 70/100 ml. The Public Health Service Manual of Recommended Practice also states that 230 MPN/100 ml should not be exceeded in more than 10 percent of the samples from approved waters.

Savannah River - Main Channels:

The average MPN values for both total and fecal coliform bacteria observed in the main channels of the Savannah River during the August, 1963 survey are shown on the bar chart in Figure 4.

Results on individual samples, collected at 2-hour intervals throughout the entire 12-hour tidal cycle, ranged above and below the illustrated averages in response to movement of the main pollutional mass up and down the channel, and to the varying quantities of dilution by fresh water entering the upper reaches during ebb tide and the ocean water entering the mouth during flood tide.

During ebb tide the mass of polluted water moves down

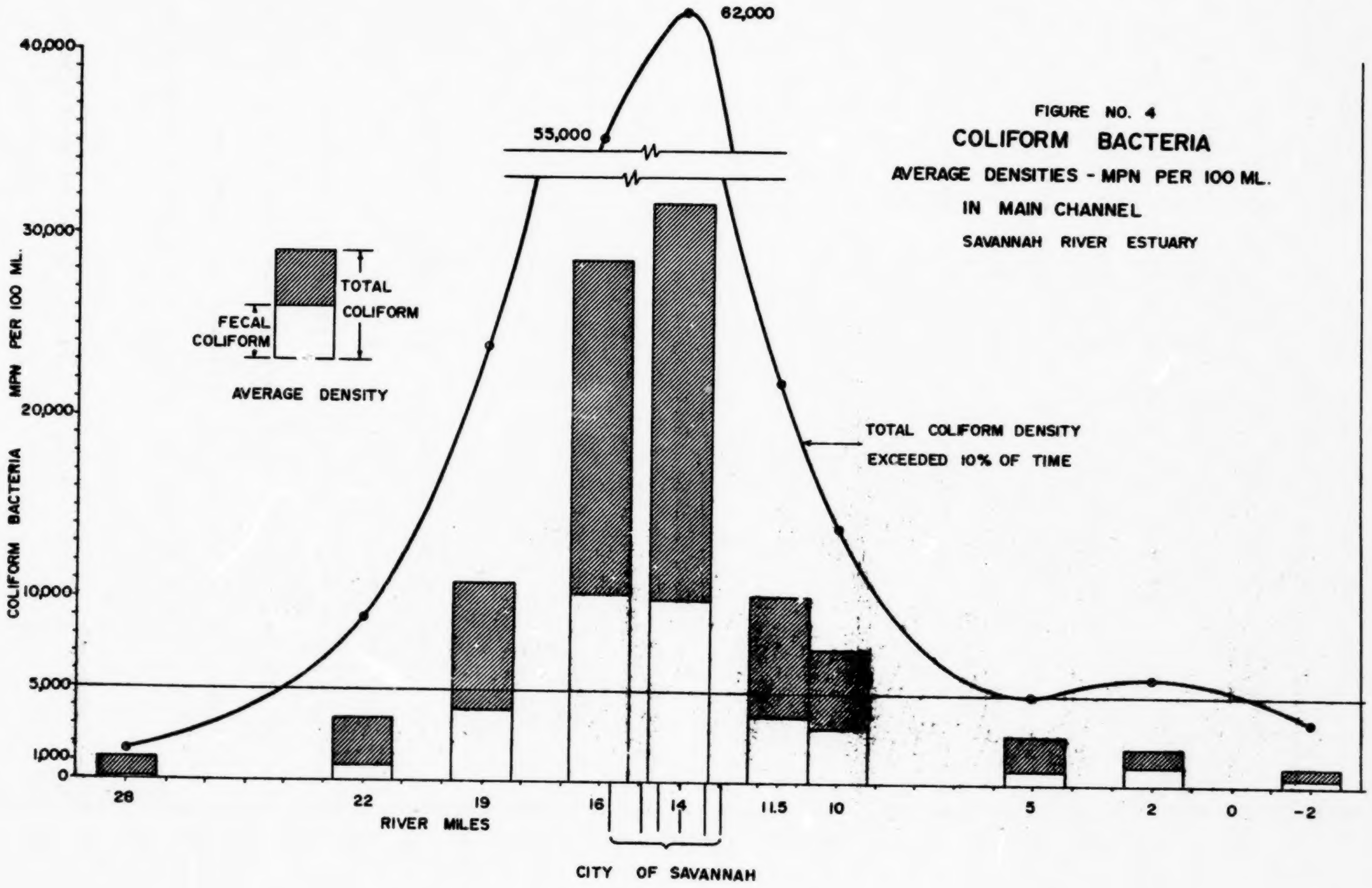


FIGURE NO. 4

COLIFORM BACTERIA

AVERAGE DENSITIES - MPN PER 100 ML.

IN MAIN CHANNEL

SAVANNAH RIVER ESTUARY

stream with a minimum of ocean water dilution, and about the time of low water slack the coliform densities at stations below the sources of pollution regularly exceeded the average densities. Similarly, coliform densities at stations up stream from the sources of pollution reach cyclical highs about the time of high water slack after flood tide. The coliform density that was exceeded 10 percent of the time of each sampling station, rather than the absolute maximum observation, was selected to indicate the increased coliform densities that can recur during the critical period of each tidal cycle. The values exceeded 10 percent of the time, shown as the solid line on Figure 4, exceed the average values by a ratio of about 2 to 1. The 5,000 MPN/100 ml line on Figure 4 permits comparison of the values found in the Savannah River with the total coliform water quality objective most commonly used for general aquatic recreation, exclusive of body contact sports.

At the uppermost station (R.M. 28), above known sources of pollution and the influence of tidal currents, the average coliform density of 1,200 was in the range considered acceptable for general recreation.

Total coliform densities averaged 3400 MPN/100 ml at the U. S. Highway 17 bridge (R.M. 22) above Port Wentworth. This station is within the upstream limits of tidal influence and 10 percent of the total coliform densities exceeded 9,000 MPN/100 ml.

The average coliform densities exceeded the 5,000 MPN/100 ml objective in the 9-mile reach from R.M. 19, located above the city of Savannah to R.M. 10, where the main channel branches off to South and North channels.

The average total coliform density rose to a peak of 31,800 MPN/100 ml at R.M. 14 in Georgia waters at the city of Savannah. At this station, the total coliform densities exceeded 62,000 during 10 percent of the time, and never fell below 9,000. That this increase in bacterial densities is caused primarily by bacteria derived from excreta is confirmed both by the fecal coliform densities, which averaged 10,000 and exceeded 24,000 MPN/100 ml more than 10 percent of the time, and by the known discharge of untreated raw sewage into the river above and below this sampling station.

In the interstate waters near the mouth of Back River (S-11.5-0.5), the total coliform bacterial densities averaged 10,300 and exceeded 22,000 MPN/100 ml 10 percent of the time. Fecal coliforms averaged 3,500 MPN/100 ml.

At R.M. S-10 about one-half mile above the Georgia-South Carolina State line, where the Savannah River divides to form the North and South Channel, the total coliform densities averaged 7,200 and exceeded 14,000 10 percent of the time. Fecal coliforms averaged 2,900 MPN/100 ml.

The average coliform densities at sampling stations in the interstate and intrastate reaches of the North Channel from below River Mile S-10.0 to the mouth were reduced below the 5,000 MPN/100 ml standard for general recreation. The 10 percent values, however, equalled or exceeded the objective in 8 of the 10 miles. Coliform bacteria in these waters contributed to pollution of the adjoining Wright and New rivers in South Carolina, where total coliform densities exceeded the allowable limits for shellfishing.

The 70 MPN/100 ml median and 230 MPN/100 ml decile total coliform objectives for shellfish waters were exceeded throughout the entire reach of the Savannah River included in this study.

Wright, New and Cooper Rivers:

Coliform densities continued to decrease in waters more remote from the sources of pollution, but the coliform densities of certain waters of the Wright and New Rivers in South Carolina exceeded the 70 MPN/100 ml limit for water used for shellfish harvesting.

The median total coliform and fecal coliform densities are illustrated in the bar charts of Figure 5, and a line representing the shellfishing total coliform objective of 70 MPN/100 ml is shown near the bottom of the chart. The median density, which is the density that is equalled or exceeded by 50 percent of the samples, was determined by plotting the coliform data on logarithmic probability paper.

Where Fields Cut, which is connected directly to the

North Channel of the Savannah River, enters the Wright River the median total coliform concentration reached 1,800, and the fecal coliform concentration reached 840 MPN/100 ml.

Median total coliform bacterial concentrations at the other Wright River stations ranged from 175 at the upstream station to 380 MPN/100 ml at the mouth. Median fecal coliform densities in the same reach of the Wright River ranged from 66 to 170 MPN/100 ml. The total coliform densities at these stations exceeded the 230 MPN/100 ml limit from 42 to 73 percent of the time.

A median total coliform density of 65 was observed at the uppermost station in the New River, but the medians in three of the four stations ranged from 80 upstream to 1200 MPN/100 ml at the mouth. The median fecal coliform density for three of the four stations was less than 20, and a median of 29 MPN/100 ml was observed at the mouth. The total coliform densities at all New River stations exceeded the 230 MPN/100 ml limit from 14 to 28 percent of the time.

Throughout the August, 1963, survey, the total coliform densities in Calibogue Sound and the Cooper River remained consistently below the 70 MPN/100 ml standard.

Proportionate Effects of Sewage Discharges
from Savannah Beach and the City of Savannah:

As indicated previously, raw sewage from the city of Savannah, entering the Front River channel of the Savannah River,

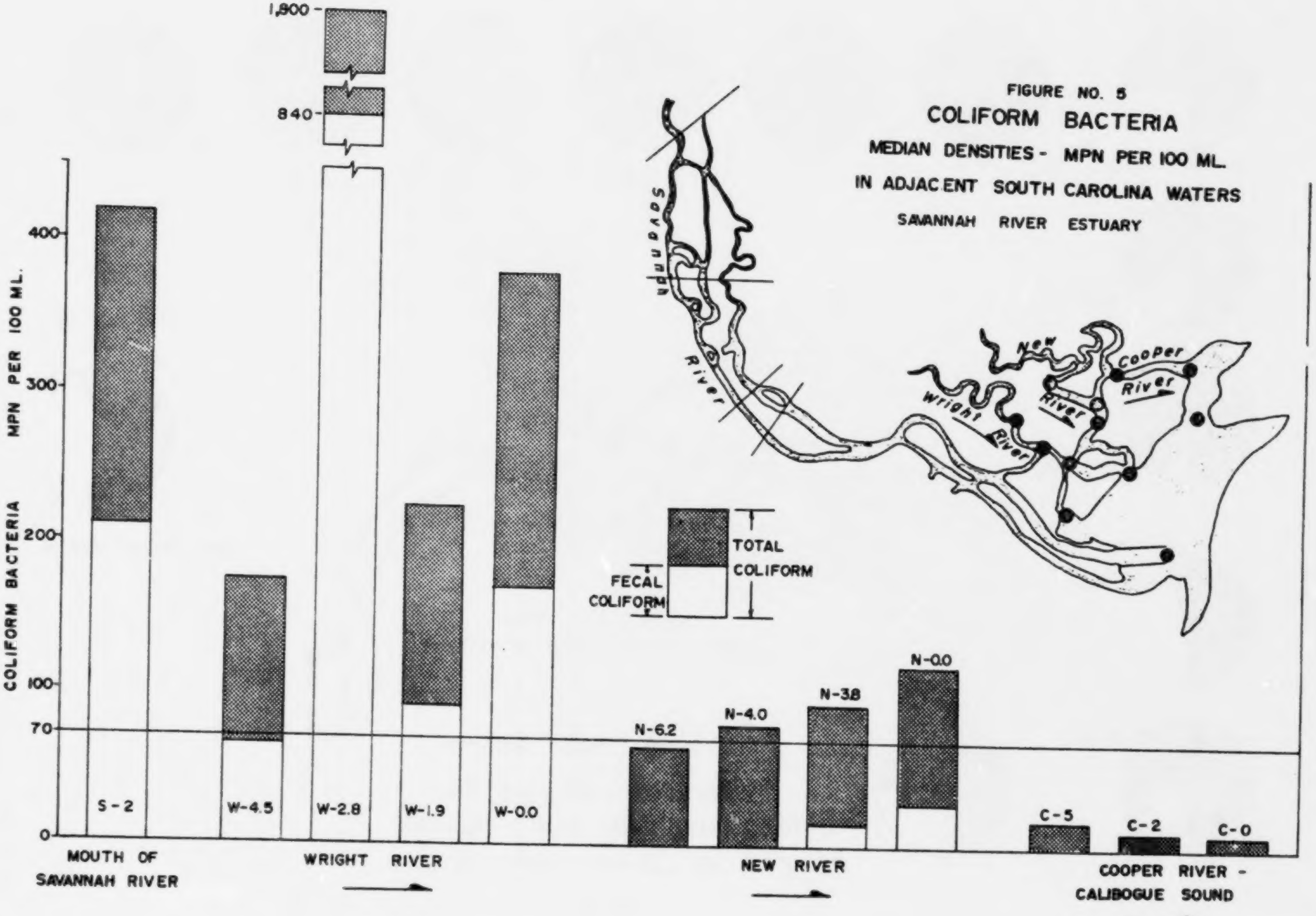


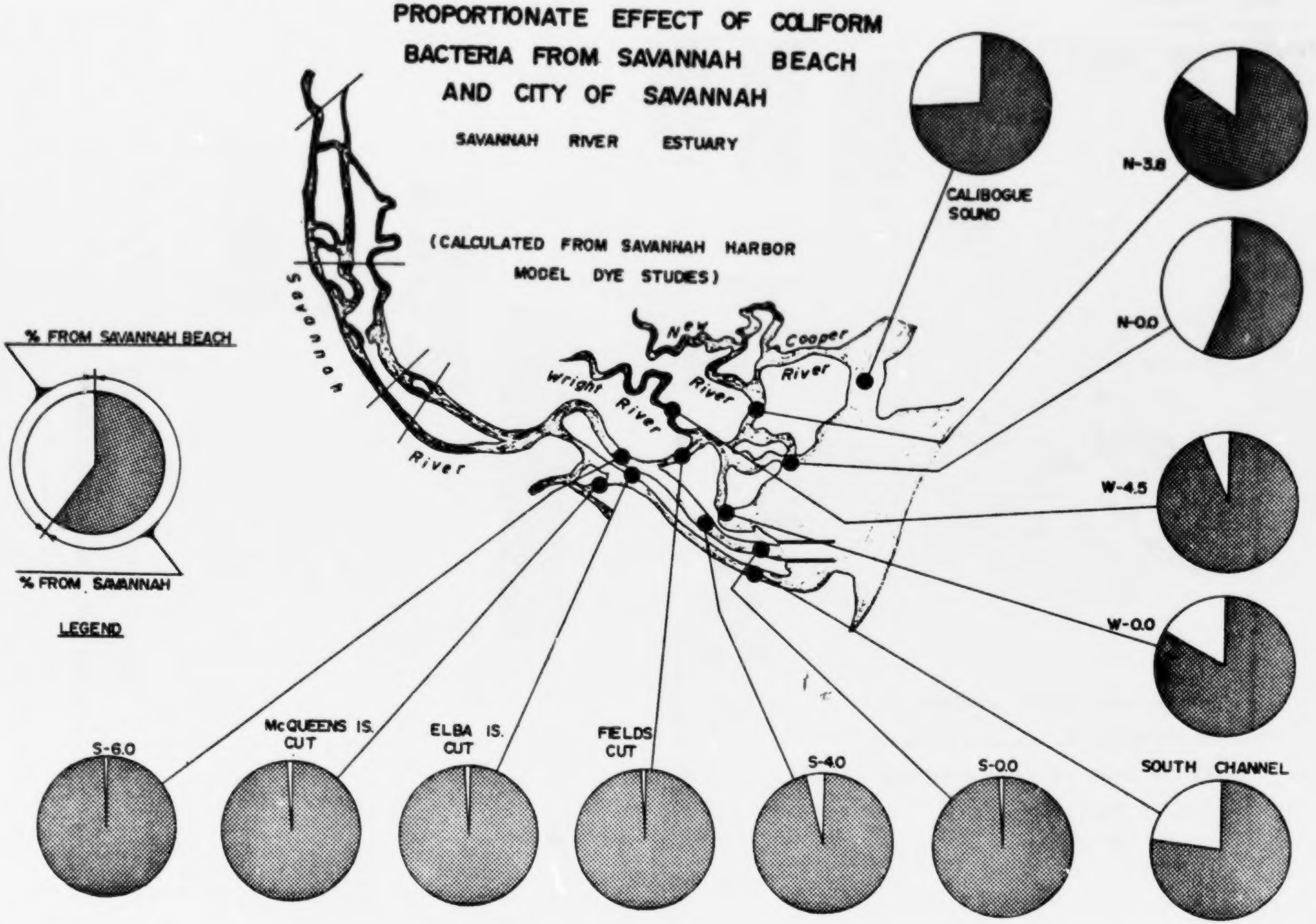
FIGURE NO. 5
COLIFORM BACTERIA
MEDIAN DENSITIES - MPN PER 100 ML.
IN ADJACENT SOUTH CAROLINA WATERS
SAVANNAH RIVER ESTUARY

FIGURE NO. 6

PROPORTIONATE EFFECT OF COLIFORM BACTERIA FROM SAVANNAH BEACH AND CITY OF SAVANNAH

SAVANNAH RIVER ESTUARY

(CALCULATED FROM SAVANNAH HARBOR MODEL DYE STUDES)


CALIBOGUE SOUND
N-3.8
N-0.0
W-4.5
W-0.0
SOUTH CHANNEL
S-0.0
S-4.0
FIELDS CUT
ELBA IS. CUT
McQUEENS IS. CUT
S-6.0
Savannah River
Wright River
New River
Cooper River
% FROM SAVANNAH BEACH
% FROM SAVANNAH
LEGEND

accounted for approximately 82 percent of the total bacterial discharge to the river. This, combined with 10 percent of the total discharged near the mouth of the South Channel from the Savannah Beach sewage treatment plant, represents about 92 percent of the total bacterial load discharged to the estuary. During studies made on the U. S. Corps of Engineers Savannah River Harbor Model, dyes were discharged into the river at the location of the city of Savannah sewers and the Savannah Beach sewage treatment plant outfall. The estimated proportionate effect of bacterial pollution from these two sources alone was calculated from the dye observations at sampling stations throughout the estuary. A summary of the Model test observations and calculations, which were based on time of travel, age of pollution, effect of dilution, and coliform die-off rates in brackish water, are illustrated on Figure 6.

Separate tests were not run on simulated discharges from all sources of pollution. The smaller jurisdictions discharging the remaining 8 percent of the total bacterial load included the 3 percent from Port Wentworth Corporation and 4 percent from Garden City. The sewage from these jurisdictions generally follows the path of the city of Savannah sewage and their respective responsibilities for pollution of the waters are in proportion to their relative discharges.

The circles in Figure 6 illustrates the estimated percent of the bacterial pollution from Savannah Beach and the city of Savannah at various points in the estuary that is attributable to each of these two sources of sewage pollution. The shaded portion shows the percent attributable to the city of Savannah.

Approximately 99 percent, or almost all of the bacteria from these two sources in the main channel and at Fields Cut came from the city of Savannah. Similarly, 94 percent of the residual 4.5 miles up the Wright River, and 85 percent at the mouth of the Wright River are also attributable to the city of Savannah discharges. This percentage is reduced near the mouth of the New River, where slightly more than one-half, or approximately 57 percent, is attributable to the city of Savannah, and approximately 43 percent is attributable to Savannah Beach. The results of this study indicate that the pollutional effects of sewage from the city of Savannah predominate, but that the unchlorinated effluent from the Savannah Beach sewage plant contributes significantly to bacterial pollution of limited areas of the South Carolina waters.

Areas Closed to Shellfishing:

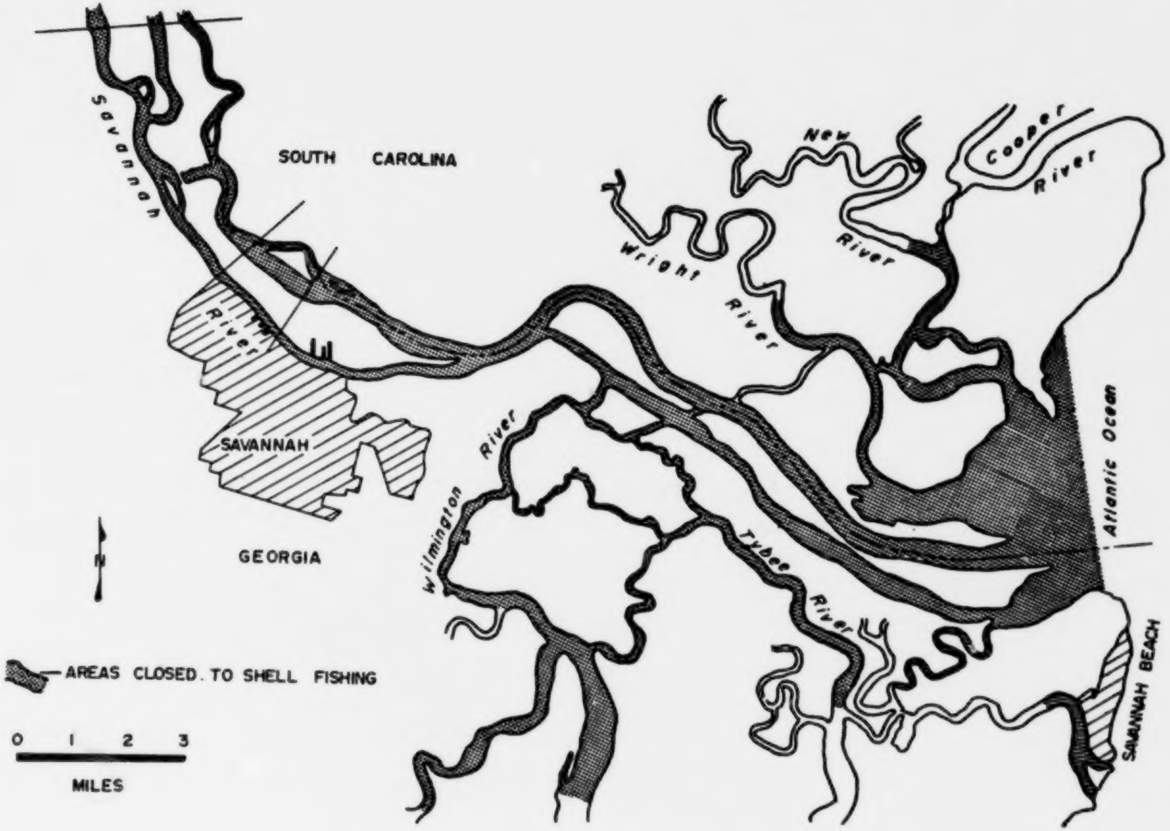
The areas closed to shellfishing are illustrated on Figure 7. The shaded areas show the main river channels, and that portion of the adjacent tidal waters that have been closed to shellfish harvesting by the Georgia and South Carolina Health Departments. These waters were closed because of the potential health hazard to persons who might consume oysters which had

FIGURE NO. 7

AREAS CLOSED TO SHELL FISHING

GEORGIA - SOUTH CAROLINA

SAVANNAH RIVER ESTUARY


Savannah
River
SOUTH CAROLINA
SAVANNAH
GEORGIA
Wright River
New River
Cooper River
Atlantic Ocean
Wilmington River
Tybee River
SAVANNAH BEACH
N
AREAS CLOSED. TO SHELL FISHING
0 1 2 3
MILES

accumulated bacteria from the raw and inadequately treated domestic sewage. Approximately 11,000 acres of coastal waters in the Savannah area are closed to shellfishing.

The South Carolina State Board of Health has condemned the areas described as "half of the Savannah River along South Carolina shores, Mud Creek, Wright River, and unmarked creeks to Tybee Roads, New River to above Ram's Horn Creek" for the taking of shellfish.

Bacterial pollution discharged to the Savannah River Estuary in Georgia causes a health hazard to persons who come in contact with the river, or who may consume oysters harvested from the estuary, in South Carolina as well as in Georgia.

Oxygen Demand and Dissolved Oxygen:

Both sewage and many industrial wastes contain organic material that decomposes and exerts an oxygen demand in the receiving waters. In the process of decomposition, oxygen derived from the atmosphere and dissolved in the water is used, and the normal content of dissolved oxygen (DO) is reduced. If the DO is reduced below an adequate level, the fish population and aquatic life on which the fish feed are reduced. Estuaries are the nurseries of many important commercial fish and shellfish. Anadromous fish, such as the American shad, pass up through estuaries to gain access to the fresh waters to spawn, and the juvenile fish return through these areas during their annual migration back to the ocean. Inadequate dissolved oxygen in a tidal river during the spring spawning run, or in late summer or early fall when the young are migrating to the ocean, can reduce or eliminate migration of anadromous fish through such areas.

Most water pollution control agencies have adopted and average of 5 mg/l as the minimum DO that is adequate to maintain the maximum potential sport fish population. Neither Georgia nor South Carolina has adopted minimum DO standards for waters in the Savannah River Estuary. In other waters of the State that have been classified, South Carolina classification standards stipulate that the dissolved oxygen in class SC waters, used for crabbing and non-commercial fishing, shall not be less than 4 ppm.

As shown on Figure 8, during the three-week August, 1963 stream survey, the average dissolved oxygen concentrations in the river were reduced from 6.5 mg/l at R.M. S-28, above the known sources of pollution, to 1.8 mg/l at R.M. S-10.0. In the interstate waters near the mouth of Back River (S-11.5-0.5) and at S-10-0, in the Georgia waters, one-half mile above the point where North Channel forms the interstate boundary, the minimum Dos near the surface, at mid-depth, and near the bottom, were all below 1.0 mg/l.

At RM S-5.0, in the interstate waters of the North Channel near Field's Cut, the average 71 DO samples amounted to 2.8 mg/l and the minimum values ranged from 1.1 near the surface to 1.6 near the bottom.

Dissolved oxygen concentrations increased at succeeding downstream stations, but even at the mouth (S-2.0), where the tidal flood flows sweep in from the ocean, the DO averaged only

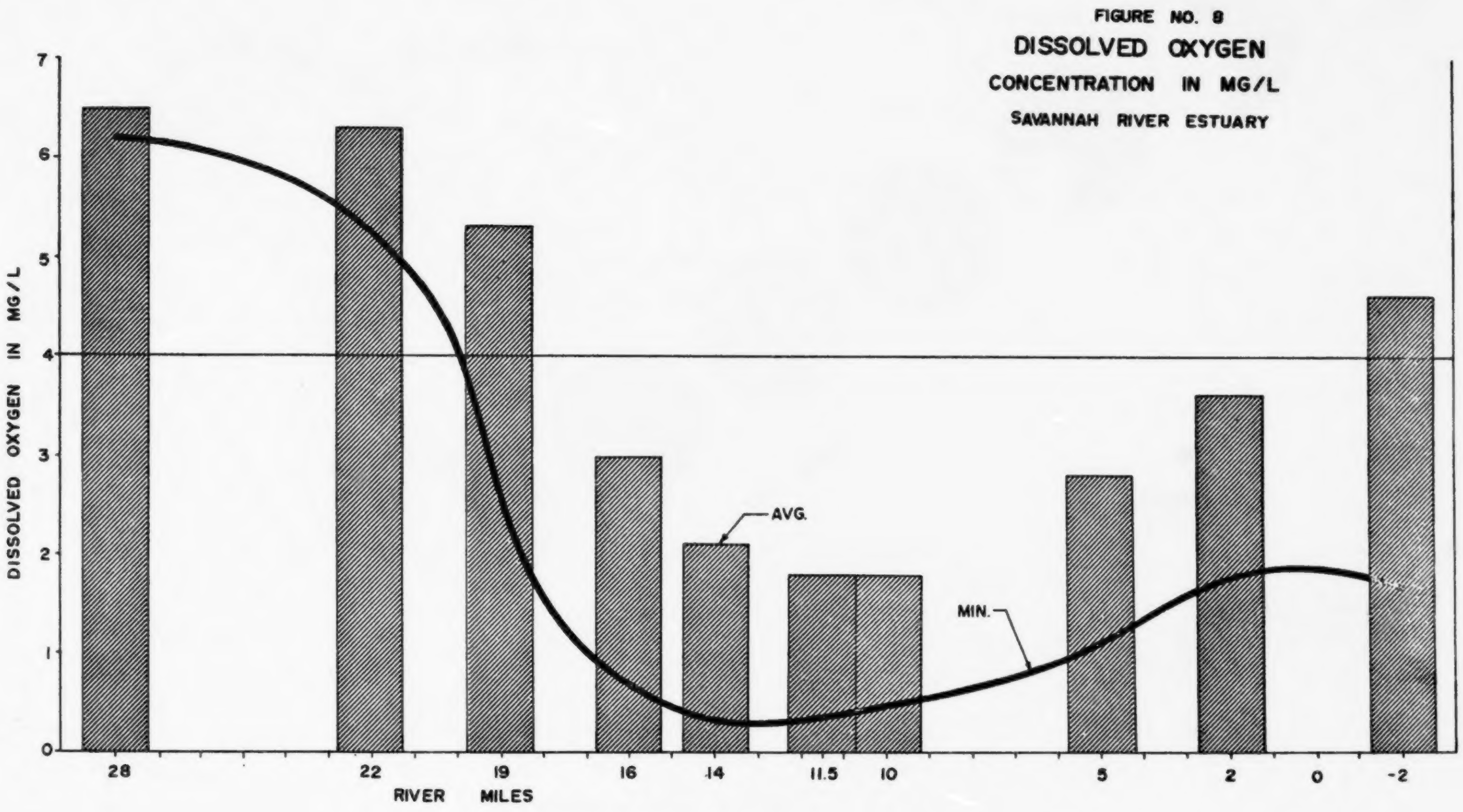


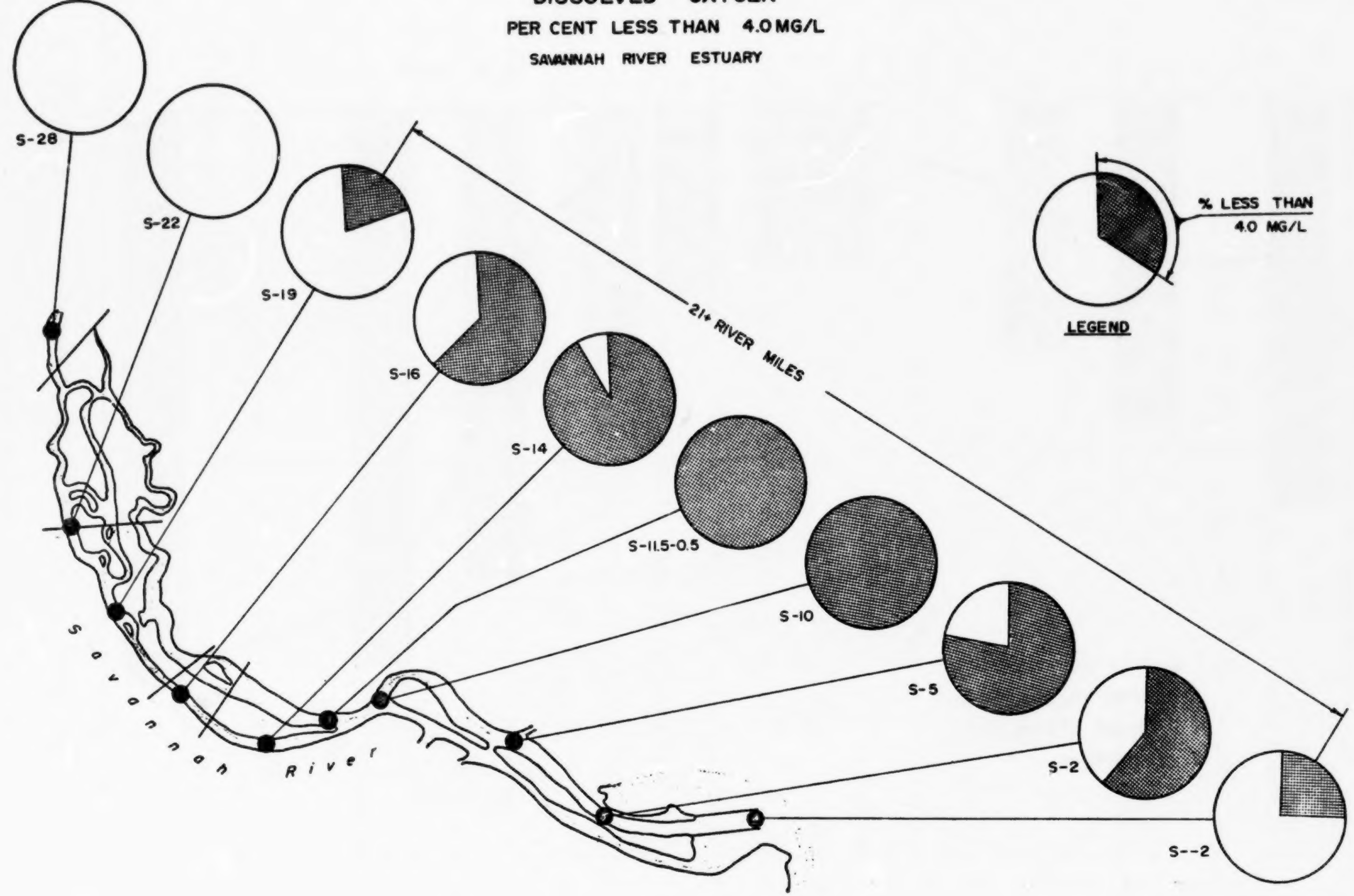
FIGURE NO. 8
DISSOLVED OXYGEN
CONCENTRATION IN MG/L
SAVANNAH RIVER ESTUARY

FIGURE NO. 9

DISSOLVED OXYGEN

PER CENT LESS THAN 4.0 MG/L

SAVANNAH RIVER ESTUARY


S-28
S-22
S-19
S-16
S-14
S-11.5-0.5
S-10
S-5
S-2
S--2
21+ RIVER MILES
% LESS THAN
4.0 MG/L
LEGEND
Savannah River

4.6 and minimum values of 1.7, 2.7, and 3.2 were observed near the surface, at mid-depth, and near the bottom.

On Figure 9, the percent of samples containing less than 4.0 mg/l of DO is shown by the shaded area in each circle. The DO in the river was frequently less than 4.0 mg/l at all sampling stations in the 21 mile reach from S-19, off shore from the Chatham County industrial complex, down to the mouth. All samples collected from the interstate waters at the mouth of Back River and from the Georgia waters at S-10 contained less than 4.0 mg/l of DO.

Three-quarters of the samples collected from the interstate waters at S-5 near Fields Cut contained less than 4.0 mg/l. At this station, 60 percent of the samples contained less than 3.0, and 21 percent contained less than 2.0 mg/l of DO.

Oxygen-demanding pollution entering the river in Georgia reduced the dissolved oxygen levels of waters in Georgia and South Carolina below the generally accepted water quality objectives for the propagation of fish and other desirable forms of aquatic life.

Oil Pollution:

Accidental oil spills have occurred occasionally during oil transfer operations at marine terminals in the harbor. Because of the attendant fire hazard, oil companies report such spills promptly, and the U.S. Coast Guard proceeds to the scene immediately and injects Gamelen Solvent D into the water to emulsify the oil and eliminate the oil slick. Those responsible for an unreported oil spill are subject to a $2,000 fine.

Radioactivity:

The E. I. DuPont de Nemours Company operates an atomic energry installation under contract with the U. S. Atomic Energy Commission in an area adjoining the Savannah River some 25 river miles below Augusta, Georgia, and about 150 river miles above the study area. The discharge of radioactive wastes to the river is under careful control and surveillance. Although this location is about 150 river miles above the limit of the study area, the possibility of radioactive pollution was investigated because of the persistence of some radioisotopes.

The Public Health Service maintains national Water Pollution Surveillance System stations on the Savannah River near Augusta, Georgia, above the atomic energy installation, and at Port Wentworth at R.M. 22, which is below the atomic energy installation and within the study area. Comparison of data on gross radioactivity at these two stations has shown that the atomic energy installation is not contributing significant radioactivity to the Savannah River.

APPENDIX

Table No. A

SAMPLING AND REFERENCE POINT LOCATIONS

August, 1963 Survey
Savannah River Estuary

River Mile	Aug. 1963 Field Station	Description	Dye Test Stations Test Nos. 1,2,3,4	Dye Test Stations Test No. 5
Savannah River (Main Channel)				
28.0	11	Upper Limit Aug. 1963 Survey		
27.0		Atlantic Coastline R.R. Bridge		
23.0			27	
22.0	9	Atlantic Coastal Hwy. Bridge(US-17)		
21.6		Upper Industrial Limit (Dye Release)		
20.9		Continental Can Co.		
20.7		Port Wentworth Sewer Outfall		
20.4		Port Wentworth Sewer Outfall		
20.0		Port Wentworth Sewer Outfall		
20.0			18	
19.9		Atlantic Creosoting Co.		
19.8		Savannah Sugar Corp.		
19.4		Amer. Bitumuls & Asphalt Co.		
19.4		Southern Nitrogen Co., Inc.		
19.0	8			
18.5		Pipemakers Canal		
18.0			19	
17.7		Southland Oil Corp.		
17.4		Hercules Powder Co.		
17.4		The Ruberoid Co.		
17.4		Amer. Agricultural Chem .		

Table No. A
Cont.

SAMPLING AND REFERENCE POINT LOCATIONS

August, 1963 Survey
Savannah River Estuary

River Mile	Aug. 1963 Field Station	Description	Dye Test Stations Test Nos. 1,2,3,4	Dye Test Stations Test No. 5
Savannah River (Main Channel) Cont.				
17.4		Dundee Canal		
17.3		Allied Chem. Corp. - Gen. Chem. Div.		
17.3		Certain-Teed Product Corp.		
17.1		American Oil Co.		
17.0		Johns-Manville Products Corp.		
16.7		Dixie Asphalt		
16.6		Union Bag-Camp Paper Corp. (Dye Release		
16.5		Seaboard Airline R. R. Bridge		
16.2		Wesson Div. - Hunt Food & Ind. Inc.		
16.2		Virginia-Carolina Chem. Corp.		
16.1		Southern Cotton Oil Co.		
16.0	7		20	
15.7		Colonial Oil Industries Terminal		
15.7		Savannah City Sewer Outfall		
15.1		Talmadge Memorial Bridge		
15.0		Meddin Packing Co.		
15.0		Savannah & Ogeechee Canal		
14.9		Savannah City Sewer Outfall		
14.6		Savannah City Sewer Outfall		
14.6		Gulf Oil Corp.		
14.5		So. Fertilizer & Chem. Co.		
14.5		Bull St. - City of Savannah (Dye Release)		

Table No. A
Cont.

SAMPLING AND REFERENCE POINT LOCATIONS

August, 1963 Survey
Savannah River Estuary

River Mile	Aug. 1963 Field Station	Description	Dye Test Stations	
			Test Nos. 1,2,3,4	Test No. 5
Savannah River (Main Channel) Cont.				
14.0	6		21	
13.9		Savannah City Sewer Outfall		
13.3		Savannah City Sewer Outfall		
13.1			128	
13.0		Southern States Phosphate & Fertilizer Co.		
12.9		Savannah City Sewer Outfall		
11.7		Atlantic Refining Co.		
11.6		Pure Oil Co.		
11.5		Standard Oil Co.		
11.5-0.5	5	Back River	15	
11.0			22	
10.5		American Cyanamid		
10.2		Lower Industrial Limit (Dye Release)		
10.0	4	North & South Channel Branch Off		
Savannah River (North Channel)				
8.0			23	
7.4			157	
6.0			24	16
5.0	3	Vicinity of Fields Cut		
4.0			25	14
2.0	2			

Table No. A
Cont.

SAMPLING AND REFERENCE POINT LOCATIONS

August, 1963 Survey
Savannah River Estuary

River Mile	Aug. 1963 Field Station	Description	Dye Test Stations Test Nos. 1,2,3,4	Dye Test Stations Test No. 5
Savannah River (North Channel) Cont.				
0.0		Fort Pulaski Natl. Monument	26	7
-2.0	1			
-5.0		Savannah River, Main Channel	28	
Savannah River (South Channel)				
9.5		South Channel	6	
1.0		South Channel - Ft. Pulaski	5	6
Savannah River (Middle River)				
		Middle River Opposite RM 21.6	17	
Wright River				
4.5	15	Wright River	9	12
2.8	14	Wright River		
0.0	12	Wright River, Mouth	12	8
	13	Walls Cut		19
		Fields Cut	8	13
New River				
6.2	19	New River		20
4.0	18	New River		
3.8	17	New River	10	10
0.0	16	New River, Mouth	11	2

Table No. A
Cont.

SAMPLING AND REFERENCE POINT LOCATIONS

August, 1963 Survey
Savannah River Estuary

River Mile	Aug. 1963 Field Station	Description	Dye Test Stations	
			Test Nos. 1,2,3,4	Test No. 5
Cooper River - Calibogue Sound				
5.0	22	Cooper River		
3.6		Cooper River		21
2.0	21	Cooper River, Mouth		
1.0		Calibogue Sound	13	11
0.0	20	Calibogue Sound		
Wilmington River				
5.0		Wilmington River, Hwy. 80 Crossing	2	
1.8		Wilmington River, Couston Bluff	1	
0.3		Wilmington River	3	
Other Stations				
		Savannah Beach, 600 yds. East of T.P.		4
		Savannah Beach, Base of 2nd St.	14	3
		Savannah Beach, Public Boat Landing, 16th St.		2
		Tybee Creek, Mouth		1
		Lazaretto Creek, Mouth		5
		McQueens Island Cut	4	17
		Elba Island Cut	7	15
		Tybee River	31	18

Table No. B

TOTAL COLIFORM BACTERIA (MPN/100 ml)

August, 1963 Survey
Savannah River Estuary

Station Location River Mile	Station Location Lab. No.	No. of Samples	Total Coliform Densities (MPN/100 ml) Median Value	Values Exceeded 10% of Time	Values Exceeded 90% of Time	Arith. Average	Max.	Min.	% of Time Various Water Use Objectives Were Exceeded 70	230	1,000	5,000
Savannah River												
S-28	11	9	1,100	1,720	330	1,220	1,720	330	100	100	60	0
S-22	9	11	2,400	9,000	600	3,430	9,200	790	100	100	80	24
S-19	8	11	7,000	> 24,000	2,400	10,850	> 24,000	2,400	100	100	100	58
S-16	7	26	21,000	55,000	9,000	28,600	92,000	5,400	100	100	100	100
S-14	6	26	24,000	62,000	9,000	31,800	160,000	9,200	100	100	100	100
S-11.5-0.5	(5)	28	8,000	22,000	3,000	10,300	34,800	2,200	100	100	100	73
S-10	4	27[1]	5,500	14,000	2,200	7,250	> 24,000	1,720	100	100	100	54
S-5	3	29[2]	2,200	5,000	270	2,650	9,200	230	100	100	75	10
S-2	2	31	1,300	6,000	150	2,080	9,200	200	100	85	50	12
S--2	1	30	420	3,500	50	1,050	5,420	40	86	64	30	7
Wright River												
W-4.5	15	28	175	990	32	350	2,100	20	76	42	10	0
W-2.8	14	28	1,800	6,100	52	2,200	9,200	40	86	71	57	18
W-1.9	13	29	225	960	50	460	1,720	80	85	49	9	0
W-0.0	12	29	380	1,090	130	500	1,700	< 200	100	73	12	0

1. Not including questionable > 240,000 MPN/100 ml 1:30 PM 8/13/63.
2. Not including questionable 24,000 MPN/100 ml 4:45 PM 8/21/63.

Table No. C cont.

FECAL COLIFORM BACTERIA (MPN/100 ml)

August, 1963 Survey
Savannah River Estuary

Station Location River Mile	Station Location Lab. No.	No. of Samples	Fecal Coliform Densities (MPN/100 ml) Median Value	Fecal Coliform Densities Values Exceeded 10% of Time	Fecal Coliform Densities Values Exceeded 90% of Time	Fecal Coliform Densities Arith. Average	Fecal Coliform Densities Max.	Fecal Coliform Densities Min.	Ratio - Fecal/Total Coliforms Median Value	Ratio - Fecal/Total Coliforms Arith. Average	Ratio - Fecal/Total Coliforms 10%	Ratio - Fecal/Total Coliforms 90%
New River												
N-6.2	19	28	< 20	58	< 20	< 28	110	< 20	-	-	-	0.20
N-4.0	18	29	< 20	54	< 20	< 26	80	< 20	-	-	-	0.15
N-3.8	17	30	15	63	< 20	29	80	< 20	0.16	0.22	-	0.21
N-0.0	16	27	29	110	< 20	46	130	< 20	0.24	0.21	-	0.22
Cooper River - Calibogue Sound												
C-5	22	23	< 20	37	< 20	< 23	90	< 20	-	-	-	0.46
C-2	21	23	< 20	46	< 20	< 27	130	< 20	-	-	-	0.11
C-0	20	22	< 20	28	< 20	< 21	50	< 20	-	-	-	0.25

FECAL COLIFORM BACTERIA (MPN/100 ml)

Table No. C

August, 1963 Survey
Savannah River Estuary

Station Location		No. of Samples	Fecal Coliform Densities (MPN/100 ml)						Ratio - Fecal/Total Coliforms			
River Mile	Lab. No.		Median Value	Values Exceeded 10% of Time	Values Exceeded 90% of Time	Arith. Average	Max.	Min.	Median Value	Arith. Average	10%	90%
Savannah River												
S-28	11	9	130	470	40	180	490	20	0.12	0.15	0.12	0.27
S-22	9	11	300	4,500	130	860	3,480	130	0.12	0.25	0.22	0.50
S-19	8	11	2,300	13,000	800	3,900	9,200	790	0.33	0.36	0.33	-
S-16	7	26	6,100	26,000	2,200	10,350	54,200	1,720	0.29	0.36	0.24	0.47
S-14	6	26	9,000	24,000	3,500	10,000	34,800	2,210	0.38	0.31	0.39	0.39
S-11.5-0.5	(5)	28	3,000	8,700	860	3,530	10,900	500	0.38	0.34	0.29	0.40
S-10	4	27[1]	2,300	5,000	500	2,930	9,200	330	0.42	0.40	0.23	0.36
S-5	3	29[2]	500	1,700	150	780	2,300	130	0.23	0.29	0.56	0.34
S-2	2	31	400	2,700	150	1,020	5,420	110	0.40	0.49	1.00	0.45
S--2	1	30	210	1,200	30	420	3,300	< 20	0.50	0.40	0.60	0.34
Wright River												
W-4.5	15	28	66	360	< 20	130	790	< 20	0.38	0.37	-	0.35
W-2.8	14	28	840	3,100	< 20	1,050	3,480	< 20	0.47	0.48	-	0.51
W-1.9	13	29	92	480	18	180	800	< 20	0.41	0.39	0.36	0.50
W-0.0	12	29	170	490	58	220	700	50	0.45	0.44	0.45	0.45

1. Not including questionable > 240,000 MPN/100 ml 1:30 PM 8/13/63.
2. Not including questionable 5,420 MPN/100 ml 4:45 PM 8/21/63.

Table No. C cont.

FECAL COLIFORM BACTERIA (MPN/100 ml)

August, 1963 Survey
Savannah River Estuary

Station Location River Mile	Station Location Lab. No.	No. of Samples	Fecal Coliform Densities (MPN/100 ml) Median Value	Fecal Coliform Densities (MPN/100 ml) Values Exceeded 10% of Time	Fecal Coliform Densities (MPN/100 ml) Values Exceeded 90% of Time	Fecal Coliform Densities (MPN/100 ml) Arith. Average	Fecal Coliform Densities (MPN/100 ml) Max.	Fecal Coliform Densities (MPN/100 ml) Min.	Ratio - Fecal/Total Coliforms Median Value	Ratio - Fecal/Total Coliforms Arith. Average	Ratio - Fecal/Total Coliforms 10%	Ratio - Fecal/Total Coliforms 90%
New River												
N-6.2	19	28	< 20	58	< 20	< 28	110	< 20	-	-	-	0.20
N-4.0	18	29	< 20	54	< 20	< 26	80	< 20	-	-	-	0.15
N-3.8	17	30	15	63	< 20	29	80	< 20	0.16	0.22	-	0.21
N-0.0	16	27	29	110	< 20	46	130	< 20	0.24	0.21	-	0.22
Cooper River - Calibogue Sound												
C-5	22	23	< 20	37	< 20	< 23	90	< 20	-	-	-	0.46
C-2	21	23	< 20	46	< 20	< 27	130	< 20	-	-	-	0.11
C-0	20	22	< 20	28	< 20	< 21	50	< 20	-	-	-	0.25

Table No. D

PROPORTIONATE EFFECT OF SIMULATED SEWAGE DISCHARGES FROM SAVANNAH BEACH AND THE CITY OF SAVANNAH

Calculated from dye study tests on
the Savannah Harbor Model*
(May-June, 1963 Model Studies)

Station Location		High Water Slack		Low Water Slack		Median	
River Mile	Model Station No.	City of Savannah (%)	Savannah Beach (%)	City of Savannah (%)	Savannah Beach (%)	City of Savannah (%)	Savannah Beach (%)
Savannah River							
S-6	24-16	98	2	100	0	> 99	< 1
S-4	25-14	87	13	> 99	< 1	96	4
S-0	26- 7	69	31	> 99	< 1	99	1
Fields Cut							
-	8-13	> 99	< 1	98	2	99	1
Wright River							
W-4.5	9-12	94	6	96	4	94	6
W-0	12- 8	80	20	90	10	85	15
New River							
N-3.8	10-10	80	20	89	11	86	14
N-0	11- 9	31	69	91	9	57	43

Table No.D Cont.

PROPORTIONATE EFFECT OF SIMULATED SEWAGE DISCHARGES FROM SAVANNAH BEACH AND THE CITY OF SAVANNAH

Calculated from dye study tests on
the Savannah Harbor Model*
(May-June, 1963 Model Studies)

Station Location		High Water Slack		Low Water Slack		Median	
River Mile	Model Station No.	City of Savannah (%)	Savannah Beach (%)	City of Savannah (%)	Savannah Beach (%)	City of Savannah (%)	Savannah Beach (%)
Calibogue Sound							
C-1	13-11	75	25	70	30	72	28
Elba Island Cut							
-	7-15	98	2	> 99	< 1	99	1
Coastal Waterway							
-	4-17	99	1	> 99	< 1	99	1
South Channel							
-	5- 6	14	86	96	4	77	23
Tybee River							
-	31-18	91	9	99	1	96	4

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* Percent of the total simulated pollution from Savannah Beach and the city of Savannah, remaining throughout the Estuary at equilibrium after 50 tidal cycles, attributable to each of these two sources.

Residual dye readings reflect the effects of dilution; the time of travel and age of dye at each location was calculated from the model data; and all observed concentrations were reduced according to a time-dependent bacterial die-off rate for brackish water.

Table No. E

DISSOLVED OXYGEN (D.O. in mg/1)

August, 1963 Survey
Savannah River Estuary

Station Location							% of Samples Below Critical Levels				
River Mile	Lab. No.	Depth	No. of Samples	Arith. Average	Max.	Min.	Below 5.0	Below 4.0	Below 3.0	Below 2.0	Below 1.0
S-28	11	5'	9	6.5	6.9	6.2	0	0	0	0	0
		15'	7	6.5	6.7	6.3	0	0	0	0	0
		28'	0	-	-	-	-	-	-	-	-
		Avg.	16	6.5			0	0	0	0	0
S-22	9	5'	11	6.4	7.2	5.5	0	0	0	0	0
		15'	11	6.4	7.3	5.5	0	0	0	0	0
		28'	6	6.0	6.6	5.3	0	0	0	0	0
		Avg.	28	6.3			0	0	0	0	0
S-19	8	5'	10	5.3	6.6	3.1	30	20	0	0	0
		15'	10	5.3	6.4	2.5	20	20	20	0	0
		28'	11	5.2	6.2	2.5	27	18	18	0	0
		Avg.	31	5.3			26	19	13	0	0
S-16	7	5'	25	3.1	5.5	1.1	84	68	52	24	0
		15'	26	3.1	5.2	1.2	92	62	54	19	0
		28'	24	2.9	5.0	0.7	92	62	50	33	4
		Avg.	75	3.0			89	64	52	25	1

Table No.E
cont.

DISSOLVED OXYGEN (D.O. in mg/l)

August, 1963 Survey
Savannah River Estuary

Station Location River Mile	Lab. No.	Depth	No. of Samples	Arith. Average	Max.	Min.	% of Samples Below Critical Levels Below 5.0	Below 4.0	Below 3.0	Below 2.0	Below 1.0
S-14	6	5'	26	2.3	4.4	0.8	100	88	77	38	12
		15'	26	2.3	4.2	0.5	100	88	69	42	19
		28'	25	1.8	3.6	0.3	100	100	84	68	28
		Avg.	77	2.1			100	92	77	49	20
S-11.5-0.5	5	5'	27	1.9	3.7	0.6	100	100	89	52	15
		15'	27	1.8	3.6	0.1	100	100	89	59	15
		28'	16	1.5	2.8	0.4	100	100	100	69	38
		Avg.	70	1.8			100	100	92	59	20
S-10	4	5'	27	2.0	3.6	0.8	100	100	89	59	7
		15'	28	1.4	3.0	0.5	100	100	96	46	7
		28'	26	1.6	2.8	0.6	100	100	100	69	12
		Avg.	81	1.8			100	100	95	58	9
S-5	3	5'	24	2.7	5.0	1.1	96	79	62	33	0
		15'	24	2.8	5.0	1.3	92	75	62	21	0
		28'	23	3.0	5.1	1.6	91	86	56	9	0
		Avg.	71	2.8			93	78	60	21	0

Table No. E
cont.

DISSOLVED OXYGEN (D.O. in mg/1)

August, 1963 Survey
Savannah River Estuary

Station Location River Mile	Station Location Lab. No.	Depth	No. of Samples	Arith. Average	Max.	Min.	% of Samples Below Critical Levels Below 5.0	Below 4.0	Below 3.0	Below 2.0	Below 1.0
S-2	2	5'	24	3.6	6.9	1.9	79	62	58	4	0
		15'	24	3.5	5.6	1.8	83	62	38	4	0
		28'	23	3.8	5.4	2.3	83	56	26	0	0
		Avg.	71	3.6			82	61	41	3	0
S--2	1	5'	22	4.4	6.6	1.7	59	32	23	4	0
		15'	22	4.5	6.2	2.7	59	32	4	0	0
		28'	21	4.8	6.3	3.2	57	10	0	0	0
		Avg.	65	4.6			58	25	9	2	0

TEMPERATURE IN °C.

Table No.F

August, 1963 Survey
Savannah River Estuary

Station Location				Field Observations		
River Mile	Lab. No.	Depth	No. of Samples	Arith. Average	Max.	Min.
Savannah River						
S-28	11	5'	9	26.9	28.0	25.5
		15'	7	26.9	28.0	26.0
		28'	1	25.5	-	-
		Avg.		26.9		
S-22	9	5'	11	27.2	28.0	26.0
		15'	11	27.0	28.0	26.0
		28'	6	26.8	27.0	26.5
		Avg.		27.0		
S-19	8	5'	11	27.3	28.0	26.0
		15'	10	27.5	28.5	27.0
		28'	11	27.4	28.5	26.5
		Avg.		27.4		
S-16	7	5'	26	27.5	29.0	27.0
		15'	26	27.5	29.0	27.0
		28'	26	27.4	29.0	24.5
		Avg.		27.5		
S-14	6	5'	26	27.8	29.0	27.0
		15'	26	27.7	29.0	27.0
		28'	26	27.6	29.5	25.0
		Avg.		27.7		

Table No.F cont.

TEMPERATURE IN °C.

August, 1963 Survey
Savannah River Estuary

Station Location			No. of Samples	Field Observations		
River Mile	Lab. No.	Depth		Arith. Average	Max.	Min.
Savannah River, cont.						
S-10	4	5'	28	28.5	29.5	27.0
		15'	28	28.5	30.0	27.0
		28'	28	28.0	29.5	26.5
		Avg.		28.3		
S-5	3	5'	31	28.5	30.0	27.0
		15'	25	28.5	29.5	27.5
		28'	30	28.0	29.5	27.0
		Avg.		28.3		
S-2	2	5'	31	28.5	29.5	27.0
		15'	25	28.5	29.0	27.5
		28'	31	28.0	29.0	27.0
		Avg.		28.3		
S--2	1	5'	31	28.5	29.5	27.0
		15'	25	28.5	29.5	27.5
		28'	31	28.0	29.0	27.0
		Avg.		28.3		
S-11.5-0.5	(5)	5'	27	28.0	29.5	27.0
		15'	17	28.0	29.5	27.0
		28'	16	28.0	29.0	27.0
		Avg.		28.0		

TEMPERATURE IN °C.

Table No. F cont.

August, 1963 Survey
Savannah River Estuary

Station Location			No. of Samples	Field Observations		
River Mile	Lab. No.	Depth		Arith. Average	Max.	Min.
Wright River						
W-4.5	15	5'	26	28.5	30.5	27.5
		15'	10	29.2	30.0	28.0
		Avg.		28.7		
W-2.8	14	5'	26	28.4	29.5	27.5
		15'	11	28.8	29.5	28.0
		Avg.		28.5		
W-1.9	13	5'	28	28.3	29.5	27.5
		15'	12	28.6	29.5	28.0
		Avg.		28.4		
W-0.0	12	5'	26	28.2	29.5	27.0
		15'	13	28.5	29.5	27.5
		Avg.		28.3		
New River						
N-6.2	19	5'	30	28.7	30.5	27.0
		15'	1	29.0	-	-
		28'	23	28.8	30.5	27.5
		Avg.		28.8		
N-4.0	18	5'	30	28.4	30.5	27.0
		15'	9	28.4	30.5	27.0
		28'	13	28.6	30.0	27.5
		Avg.		28.5		

Table No. F cont.

TEMPERATURE IN °C.

August, 1963 Survey
Savannah River Estuary

Station Location			No. of Samples	Field Observations		
River Mile	Lab. No.	Depth		Arith. Average	Max.	Min.
New River, cont.						
N-3.8	17	5'	30	28.5	30.5	27.0
		15'	-	-	-	-
		28'	24	28.5	30.5	27.0
		Avg.		28.5		
N-0.0	16	5'	29	28.4	30.0	27.0
		15'	4	29.2	30.0	27.5
		28'	20	28.1	29.5	27.0
		Avg.		28.2		
Cooper River - Calibogue Sound						
C-5	22	5'	23	29.2	31.5	27.5
		28'	23	29.4	31.5	27.5
		Avg.		29.3		
C-2	21	5'	23	29.1	31.5	27.5
		28'	23	29.1	31.0	27.5
		Avg.		29.1		
C-0	20	5'	23	28.4	30.5	28.0
		28'	23	28.8	30.5	27.5
		Avg.		28.6		

Table No. G

pH

August, 1963 Survey
Savannah River Estuary

Station Location			No. of Samples	Field Observations		
River Mile	Lab. No.	Depth		Arith. Average	Max.	Min.
Savannah River						
S-28	11	5'	4	6.6	6.8	6.4
		15'	2	6.5	6.6	6.3
		28'	1	6.2	6.2	6.2
		Avg.		6.6		
S-22	9	5'	6	6.4	6.8	6.8
		15'	6	6.4	6.6	6.3
		28'	3	6.5	6.8	6.2
		Avg.		6.4		
S-19	8	5'	6	6.7	6.8	6.6
		15'	5	6.6	6.8	6.3
		28'	6	6.6	6.8	6.4
S-16	7	5'	25	6.2	6.8	5.0
		15'	25	6.2	6.8	5.0
		28'	25	6.2	6.6	5.0
		Avg.		6.2		
S-14	6	5'	25	6.2	6.7	5.2
		15'	24	6.2	6.9	5.4
		28'	24	6.3	6.8	5.6
		Avg.		6.2		

pH

Table No.G cont.

August, 1963 Survey
Savannah River Estuary

Station Location			No. of Samples	Field Observations		
River Mile	Lab. No.	Depth		Arith. Average	Max.	Min.
Savannah River, cont.						
S-10	4	5'	28	6.4	7.0	5.6
		15'	28	6.4	7.2	5.6
		28'	28	6.5	7.2	5.1
		Avg.		6.4		
S-5	3	5'	24	6.8	7.2	6.2
		15'	24	6.8	7.6	6.0
		28'	24	7.0	7.6	6.4
		Avg.		6.9		
S-2	2	5'	25	7.0	7.6	6.2
		15'	25	7.1	7.6	6.2
		28'	25	7.2	7.6	6.4
		Avg.		7.1		
S--2	1	5'	25	7.3	7.7	6.4
		15'	25	7.2	7.6	6.4
		28'	25	7.4	7.6	6.4
		Avg.		7.3		
S-11.5-0.5	(5)	5'	27	6.4	7.0	5.8
		15'	26	6.4	7.0	5.8
		28'	16	6.3	6.9	4.2
		Avg.		6.4		

COLIFORM BACTERIA (Mean of MPN/100 ml) Table No. H

Summary of CROSS SECTION Data
Oct.-Nov., 1962 Preliminary Survey
Savannah River Estuary

River Mile	TOTAL COLIFORMS Ga. Side 5' D.	Center Channel 5' D.	S.C. Side 5'D.	Center Channel 28' D.	FECAL COLIFORMS Ga. Side 5' D.	Center Channel 5' D.	S.C. Side 5'D.	Center Channel 28' D.
20	9,500	10,100	8,500	11,600	1,770	2,330	1,120	2,130
18	13,880	10,050	8,220	-	2,860	1,700	874	-
16	26,500	> 45,400	26,500	8,150	5,180	3,020	3,070	2,760
14	38,100	38,100	34,800	8,610	5,940	9,980	8,730	3,130
10	8,200	15,850	14,100	3,380	2,210	3,010	3,650	980
8	13,720	8,940	6,170	650	3,670	2,440	1,930	190
6	6,550	7,240	5,160	460	2,450	1,539	2,140	170
2	4,900	7,950	3,250	160	800	1,110	920	50
0	1,420	4,900	1,560	80	520	2,300	520	50

Table No. I

DISSOLVED OXYGEN (Mean of mg/l and % Saturation)

Summary of CROSS SECTION Data
Oct.-Nov., 1962 Preliminary Survey
Savannah River Estuary

	D. O. (mg/l)				D. O. (% Sat.)			
River Mile	Ga. Side 5' D.	Center Channel 5' D.	S.C. Side 5'D.	Center Channel 28' D.	Ga. Side 5' D.	Center Channel 5' D.	S.C. Side 5' D.	Center Channel 28' D.
28	9.1	-	9.0	-	88	-	88	-
23	8.3	8.3	8.3	-	86	86	86	-
22	6.6	7.4	7.4	-	70	81	81	-
20	7.2	7.2	7.2	7.2	74	75	73	74
18	7.3	7.3	7.5	6.7	72	72	74	67
16	4.9	5.0	5.1	3.7	52	53	54	40
14	4.1	4.2	4.3	3.6	45	45	46	41
10	4.4	4.6	4.6	4.7	49	51	52	57
8	4.9	4.8	4.6	5.2	54	54	52	64
6	5.0	5.1	5.1	5.6	57	58	59	70
2	6.1	6.0	6.2	6.4	72	71	73	81
0	6.6	6.3	6.4	6.5	79	76	77	83

Table No. J

SAVANNAH RIVER DISCHARGE RECORDS
at USG Gage near Clyo, Ga. (River Mile S-65)

August, 1963 Survey
Savannah River Estuary

Discharge During 1963 Survey

Day	Date	Mean Daily Discharge (cfs)	Day	Date	Mean Daily Discharge (cfs)
	8/6/63	11,900		8/16/63	7,820
	7	9,900		17	8,500
	8	9,340	Sunday	18	8,980
	9	10,500		19	8,740
	10	10,900		20	8,040
Sunday	11	10,600		21	7,820
	12	9,760		22	8,260
	13	8,500		23	9,340
	14	7,710		24	10,200
	15	7,490			
				Avg.	9,170
				Max.	11,900
				Min.	7,490

Recent Water Year Records

Water Year	Mean	Max.	Min.
1962-1963	12,222	29,200	6,960
1961-1962	12,050	28,200	6,160
1960-1961	11,770	34,300	6,610
1959-1960	16,540	40,300	6,810
1958-1959	8,915	25,500	5,760

Long Term Records

30-yr.	Avg.	11,360	
	Max.	270,000	(Oct. 6, 1929)
	Min.	1,950	(Sept. 27, 1931)

Other Records

Mean during 1962 Prelim. Survey	7,180
Max. " " " "	7,380
Min. " " " "	6,960

Discharge for Savannah Harbor Model Study = 7,000

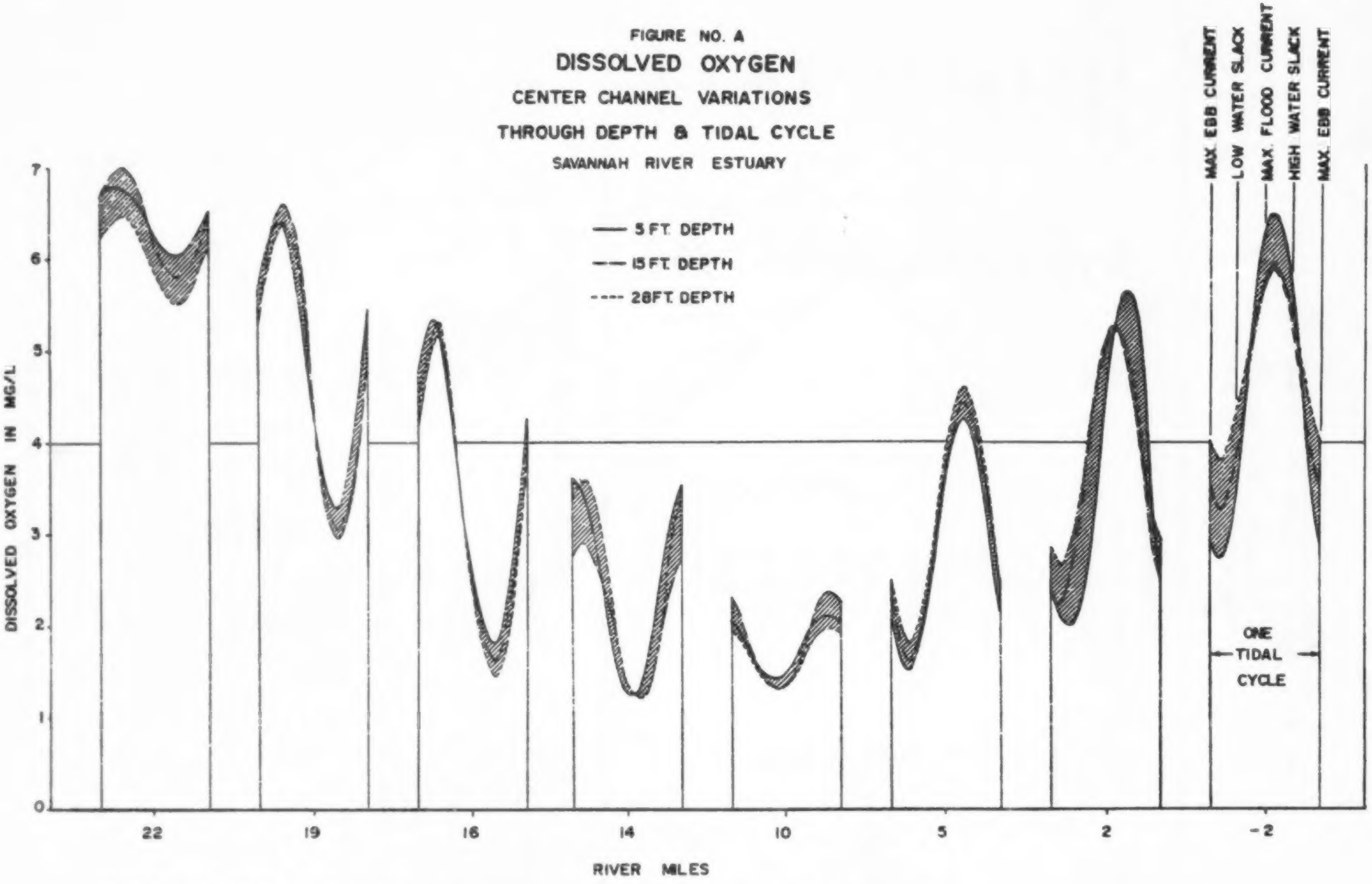
FIGURE NO. A

DISSOLVED OXYGEN

CENTER CHANNEL VARIATIONS

THROUGH DEPTH & TIDAL CYCLE

SAVANNAH RIVER ESTUARY



EACH CYCLIC PROFILE STARTS AT THE TIME MAXIMUM EBB CURRENT OCCURS AT THE MOUTH.

FIGURE NO. 8

DISSOLVED OXYGEN PROFILE

AT PERIODS OF HIGH AND LOW D.O. AT MOUTH OF CHANNEL

SAVANNAH RIVER ESTUARY

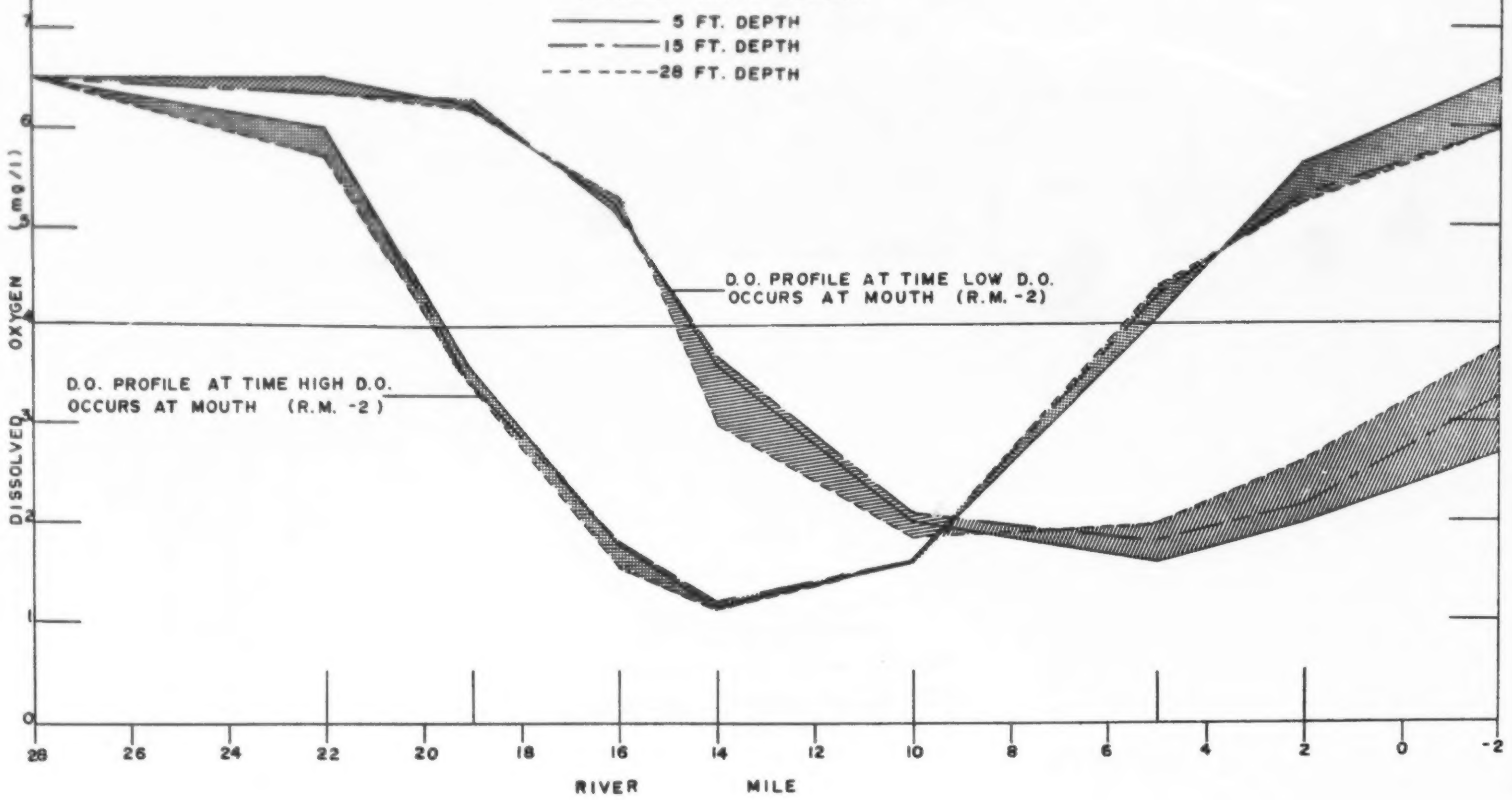
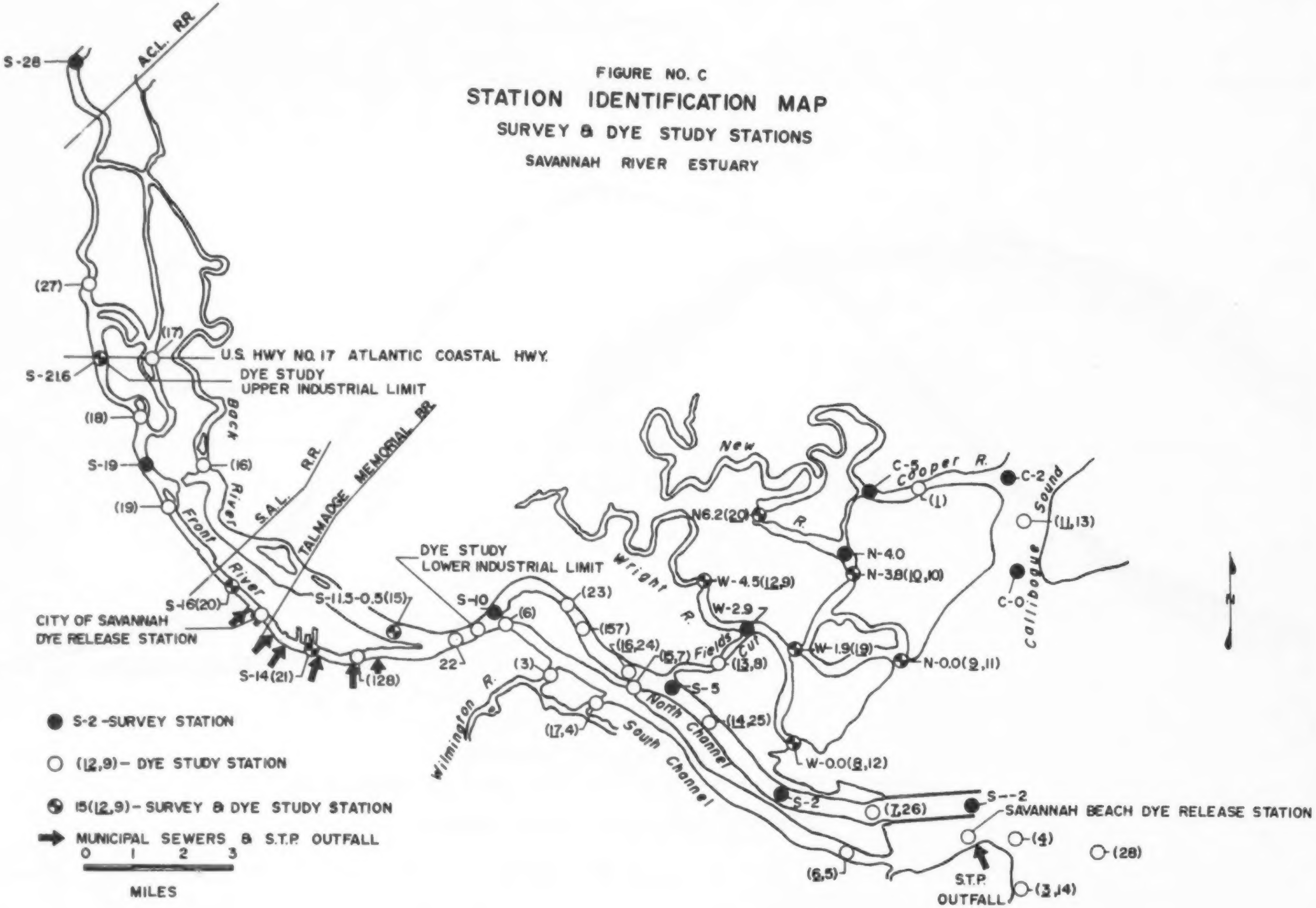


FIGURE NO. C

STATION IDENTIFICATION MAP

SURVEY & DYE STUDY STATIONS

SAVANNAH RIVER ESTUARY


S-28
A.C.L. RR
(27)
(17)
U.S. HWY NO. 17 ATLANTIC COASTAL HWY.
DYE STUDY
UPPER INDUSTRIAL LIMIT
S-21.6
(18)
Back River
(16)
S-19
(19)
Front River
S.A.L. R.R.
TALMADGE MEMORIAL BR.
S-16(20)
CITY OF SAVANNAH
DYE RELEASE STATION
S-14(21)
(128)
S-11.5-0.5(15)
DYE STUDY
LOWER INDUSTRIAL LIMIT
22
S-10
(6)
(23)
(157)
(16,24)
(15,7)
Fields Cut
(13,8)
S-5
(14,25)
(3)
(17,4)
Wilmington R.
South Channel
North Channel
Wright R.
W-4.5(12,9)
W-2.9
W-1.9(19)
W-0.0(8,12)
New R.
N6.2(20)
N-4.0
N-3.8(10,10)
N-0.0(9,11)
C-5
Cooper R.
(1)
C-2
(11,13)
Calibogue Sound
C-0
N
S-2
(7,26)
S--2
SAVANNAH BEACH DYE RELEASE STATION
(4)
(28)
(6,5)
S.T.P.
OUTFALL
(3,14)
S-2 -SURVEY STATION
(12,9)- DYE STUDY STATION
15(12,9)- SURVEY & DYE STUDY STATION
MUNICIPAL SEWERS & S.T.P. OUTFALL
0 1 2 3
MILES

LARGE MAP OF SAVANNAH PORT FACILITIES

NOT PRINTED

Available in file copy of original transcript

U.S. Department of Health, Education, and Welfare

Washington, D.C.

MR. WEST: And throughout this discussion we have some figures in the report and Mr. Runas who, incidentally, was in charge of the field activities on the Savannah River Study, will present the charts for us.

(Short pause.)

MR. STEIN: In the preconference technical operations we have had, I have always said I have never seen a projector or anything work when the lights are put out.

(Short pause.)

MR. WEST: We will see if we can put the show on the road now.

Introduction:

On the basis of reports, surveys, or studies, having reason to believe that pollution of the Savannah River Estuary originating in Georgia was endangering the health or welfare of persons in South Carolina, the Secretary of the Department of Health, Education, and Welfare called a conference of the state water pollution control agencies of Georgia and South Carolina, and the Department of Health, Education, and Welfare.

This report on pollution of interstate waters of the Savannah River Estuary is based primarily on data obtained by the Department of Health, Education,-and Welfare, through a field study conducted during August 6 through August 27, 1963. The Chatham County Health Department performed the bacteriological examinations on samples collected during this survey.

The manner in which wastes are dispersed throughout the estuary by the undulate flood and ebb tides was determine from Savannah Harbor Hydraulic Model Studies conducted by the U. S. Army Engineer Waterways Experiment Station at Vicksburg, Mississippi.

Supplementary information was provided by the Georgia State Department of Public Health, South Carolina Water Pollution Control Authority, Chatham County Health Department, City of Savannah, and representatives of industries and municipalities.

The whole-hearted and invaluable cooperation of the numerous agencies and individuals is gratefully acknowledged.

The Area:

The study area covered by this report includes the lower 28 miles of the Savannah River in the States of Georgia and South Carolina, and the connecting Wright, New and Cooper rivers in the State of South Carolina. The uppermost sampling station is located about at River Mile about seven river miles upstream from the northern limits of the 5-mile Chatham County industrial complex.

The Front River channel of the Savannah River bordering the city of Savannah, Georgia, is located in the State of Georgia. In this region, Back River forms the interstate boundary to a point just above its confluence with Front River. From this point, the State boundary follows the cut north of Burnwell

Island for about 2 miles, and then the center of the North Channel of the Savannah River for about 7 miles to Horseshoe Shoals, where it veers to the east and out into the Atlantic Ocean.

The city of Savannah, Georgia with a population of about 150,000 is by far the largest community in the area. Savannah Beach, Georgia, a resort area located along the ocean front southeast of the river mouth, attracts an estimated 25,000 population during the recreational period of the year. Other Georgia communities, including Chatham City, Garden City, and Port Wentworth, adjoin the river.

Industries located in the area include pulp and paper mills, a sugar refinery, asphalt roofing and pressure creosoting plants, marine terminals for asphalt and flammable petroleum products, and plants producing naval stores, fertilizers and chemical products.

Water Uses:

The main channels of the Savannah River in the study area are used principally for navigation, commerce, boating, industrial water supply, and waste disposal. In former years, the river and adjacent waters were used for commercial fishing and shellfish harvesting. The waters off the main channel and along the ocean front are used extensively for recreational boating, fishing, swimming, and water skiing.

Commercial Fishing:

At one time commercial fishermen fished the Savannah

River extensively for the American shad. It is reported that in recent years the flesh of the fish caught in this area was tainted with objectionable tastes and commercial buyers were reluctant to handle Savannah River fish. The commercial fishermen gradually moved to other fishing areas and the Savannah River no longer supports a commercial shad fishery.

Oysters abound in the tidal waters of the Savannah River Estuary. Some 30 years ago, this area supported a commercial shellfishing industry. Parts of the Savannah River and adjacent tidal waters are polluted by sewage, and because of the health hazard associated with the consumption of raw oysters harvested from waters containing bacteria from sewage pollution, these areas in Georgia and South Carolina have been closed to shellfishing by the State health departments, and this commercial fishery no longer exists.

Recreation:

The tidal waters of the Savannah River are used for sport fishing and recreational boating, and areas of the connecting streams and the ocean front beaches, principally in Georgia, are used for water contact sports such as swimming and water skiing. Hundreds of boats, moored in these areas, cruise these waters on the way out to the deep sea fishing areas in the Atlantic Ocean.

Sources of Wastes:

Raw and partially treated sewage and industrial wastes cause excessive pollution of certain reaches of the Savannah River in Georgia and South Carolina. The sewage discharges also cause excessive bacterial pollution of certain reaches of the Wright River and the New River in South Carolina.

Sewage:

Sewage contains many obnoxious constituents which may create health hazards, destroy desireable aquatic life and seriously degrade the value and usefulness of the receiving body of water.

In this report, the relative magnitude of sewage discharges which adversely affect water quality are described in terms of bacterial and oxygen demanding population equivalents.

For example, 1,000 population equivalents of bacteria or oxygen demanding material would be equal to the number of bacteria, or the amount of oxygen demanding material, normally contained in the raw sewage from a community of 1,000 persons.

Approximately 194,000 persons reside in the sewered sections of the total Savannah - Savannah Beach metropolitan area.

About 25 percent of this total reside in areas that are drained towards the local Vernon, Wilmington and Little Ogeeche Rivers within the state of Georgia, and are therefore outside of the area included in this report.

The other 75 percent of this total, or some 146,000 persons, reside in areas where sewage drains to the Savannah

River system that is part of, or tributary to, the interstate waters that were included in the August 1963 survey. Therefore all subsequent discussions of sewage loads and their effects on water quality and uses refer only to this 75 percent segment which drains toward the interstate waters.

Bacteria in Sewage Discharges:

The estimated bacterial content of raw and partially treated sewage entering the River are represented by the diameters of the circles illustrated on Figure No. 2.

Raw sewage from the City of Savannah is the largest source of coliform bacteria. This sewage from approximately 108,000 persons includes 82 percent of the sewage associated coliform bacteria discharged to the River.

Settled sewage from the inadequate Savannah Beach primary sewage plant is the second largest source. The 12,500 bacterial population equivalents discharged from this source amounts to approximately 10 percent of the total.

All other sewage discharges combined; including approximately 4 percent in the untreated portion of the Garden City sewage, 3 percent in raw sewage from Port Wentworth Corporation, 1 percent in the settled sewage from Chatham City, and lesser amounts from the remaining sources listed in Table 1 of the report contributed about 8 percent of the total bacterial load.

Only 10 percent of the sewage associated bacteria were removed by treatment and none of the Sewage was disinfected.

Oxygen Demand in Sewage and Industrial Wastes:

The 5-Day Biochemical Oxygen Demand of sewage and industrial wastes, usually referred to as the 5-Day BOD, measures the amount of dissolved oxygen they remove from water. Since water must contain sufficient dissolved oxygen to support fish and other desireable aquatic life; the biochemical oxygen demand reveals the pollutional strength of wastes and indicates the extent to which they may damage the receiving body of water.

The estimated oxygen demand load of sewages and industrial wastes entering the River are represented by the diameters of the circles illustrated on Figure No. 3.

Industrial wastes were responsible for almost 90 percent and sewage discharges for slightly more than 10 percent of the total biochemical oxygen demand discharged to the Savannah River Estuary.

Union Bag-Camp Paper Corporation was, by far, the largest source of oxygen demanding material. This source, containing approximately 810,000 population equivalents of 5-day BOD, amounted to 70 percent of the total BOD load discharged to the River.

Continental Can Company, the second largest source, discharged approximately 130,000 population equivalents or 11 percent of the total load.

The City of Savannah, discharging raw sewage from approximately 108,000 persons, or 9 percent of the total 5-Day

BOD load, was the third largest source.

The combined discharges from other sources, including 2.6 percent from the Savannah Sugar Corporation, 2.2 percent from the Wesson Division of Hunt Foods Corporation and 1.4 percent from Savannah Beach sewage -- all shown on Figure 3 -- plus the smaller loads listed in Tables 1 & 2 in the report, made up the remaining 10 percent of the oxygen demand load discharged to the River.

The full report also contains a list of other industries that discharge cooling and process waters containing varying amounts of oils, phenols or acids.

Disperson of Wastes:

The U. S. Army Waterways Experiment Station in Vicksburg, Mississippi, ran tests on the Savannah Harbor Hydraulic Model to determine the dispersion characteristics of waste discharges from major sources of pollution in the Savannah Harbor and to supplement the data collected during the on-site field study. Test results, including a description of the dy releases and the residual dye concentrations observed throughout the Model, were reported by the Waterways Experiment Station. The test data were processed, analyzed, and interpreted by the Public Health Service.

The results of this study will be illustrated and discussed later by Mr. Al Wastler, oceanographer with the Department of Health, Education and Welfare, who will show a movie which reveals how the dyes, released at the location of sewage and industrial waste sources, are dispersed **throughout** the model of the Savannah River Estuary.

Probable Influence of the Channel Improvement Plan
Proposed by the U. S. Army Corps of Engineers:

During one set of tests, the physical features of the Model were changed to simulate the proposed 38 ft. deep x 500 ft. wide channel in Front River and the sediment basin in Back River as proposed by the U. S. Army Engineers. Comparison of the dye data for the existing and proposed channel condition shows that, while there is some generalized movement of the dye downstream, there is no significant difference in the circulation of the dye outside of the North Channel. The dye data indicate that the proposed channel improvement plan will not significantly alter the effects of pollution on the tidal waters.

Effects of Pollution on Water Quality and Use:

Excessive bacterial pollution of a stream or estuary presents a health hazard to those who come in contact with the water, or consume raw shellfish harvested from polluted waters. Excessive oxygen demand reduces the dissolved oxygen content of water, which results in reduction or destruction of fish and desireable aquatic life.

The effects of pollution on water quality and use during the August, 1963 field study of the Savannah River Estuary were determined by total coliform, fecal coliform, dissolved oxygen and other data collected at 2-hour tidal cycles at the various sampling stations.

Bacterial Pollution:

Municipal sewage contains enormous numbers of bacteria, among which there usually are pathogenic bacteria, derived from human excreta, that can cause gastrointestinal diseases such as typhoid fever, diarrhea, and dysentery. Oysters and other shellfish accumulate bacteria in **their** bodies and shell liquors as they filter the surrounding water in the process of feeding and respiration. Shellfish in waters polluted by sewage discharges can also accumulate pathogenic bacteria and viruses, such as those producing infectious hepatitis and polio. Although the bacteria and viruses do not normally harm the oyster, they can cause illness in persons who consume raw oysters harvested from waters containing them.

Sewage also contains coliform, and specifically fecal coliform, bacteria which typically occur in excreta, or feces, from man and warm blooded animals. These bacteria, though harmless in themselves, are determined in stream studies involving sewage pollution as indicators of the probable presence of pathogenic bacteria and viruses.

The results of both, total and fecal, coliform determinations are expressed in terms of most probable numbers, or MPN, per 100 milliliters of water. Incidentally, one half cup of water holds slightly more than 100 milliliters.

Neither Georgia nor South Carolina has adopted total coliform objectives of water quality for water contact sports, such as swimming and water skiing, or for general recreational use, such as boating and fishing, for the Savannah River Estuary.

Where such objectives have been adopted, the commonly used limit for water contact sports is 1,000 per 100 milliliters of water. This swimming water standard is used by South Carolina in other classified waters of the State.

Where total coliform objectives for general recreational use have been adopted, an arithmetic average of 5,000 MPN per 100 milliliters is the commonly used upper limit.

Both states prohibit direct harvesting of shellfish for human consumption from waters polluted by sewage. Waters subject to sewage pollution are closed to shellfishing by Georgia and South Carolina State Health Departments, where sanitary surveys indicate that sewage may reach the waters, or where the median total coliform MPN value representatives of the waters of the shellfish growing areas exceed 70/100 ml. The Public Health Service Manual of Recommended Practice also states that 230 MPN/100 ml should not be exceeded in more than 10 percent of the samples from approved waters.

Savannah River -- Main Channels:

The average MPN values for both total and fecal coliform bacteria observed in the main channels of the Savannah River during the August 1963 survey are shown on the bar chart in

Figure 4. The full height of the bars represent total coliforms and the height of the clear area represents the fecal coliforms. The total coliform density that was exceeded 10 percent of the time and can be expected to recur during the critical period of each tidal cycle is shown by the curved solid line. The 5,000 MPN/100 ml line on Figure 4 permits comparison of the values found in the Savannah River with the total coliform water quality objective most commonly used for general aquatic recreation, exclusive of body contact sports.

Although a 1,000 MPN/100 ml level line is not shown on the chart, it sould be remembered that water suitable for water contact activities, such as swimming and water skiing, should not contain more than this 1,000 MPN/100ml objective.

At the uppermost sampling station, upstream from the Atlantic Coastline Rail Road Bridge, and above known sources of pollution and the influence of tidal currents, the average total coliform density of 1,200 MPN/100ml was in the range considered acceptable for general recreation.

The extent to which sewage discharges polluted the Savannah River, and created a health hazard to persons who may come in contact with the river water, is clearly revealed by the manner in which the total coliform density was increased to 31,800 on the average, and to a peak of 62,000 for 10 percent of the time, in the Georgia waters of Front River Channel adjoining the City of Savannah. The average value was 6 times, and the

10 percent value was 12 times, the 5,000 MPN/100ml objective for boating and general recreation. Furthermore, the fecal coliforms alone averaged 10,000 and exceeded 24,000 MPN/100ml more than 10 percent of the time.

In the interstate waters near the mouth of Back River, the total coliform bacterial densities which averaged 10,300 and exceeded 22,000 MPN/100 ml 10 percent of the time were 2 to 5 times the 5,000 MPN/100ml objective.

At R.M. S-10 about one-half mile above the Georgia-South Carolina State line, where the Savannah River divides to form the North and South channel, continued to exceed the objective, the total coliform densities averaged 7,200 and exceeded 14,000 10 percent of the time.

The average coliform densities at sampling stations in the interstate and intrastate reaches of the North Channel from below River Mile S-10.0 to the mouth were reduced below the 5,000 MPN/100 ml standard for general recreation. The 10 percent values, however, equalled or exceeded the objective in 8 of the 10 miles. Coliform bacteria in these waters also contributed to pollution of the adjoining Wright and New rivers in South Carolina, where total coliform densities exceeded the allowable limits for shellfishing.

The 70 MPN/100 ml median and 230 MPN/100 ml decile total coliform objectives for shellfish waters were exceeded throughout the entire reach of the Savannah River included in this study.

Wright, New, and Cooper Rivers:

Coliform densities continued to decrease in waters more remote from the sources of pollution, but the coliform densities of certain waters of the Wright and New rivers in South Carolina exceeded the 70 MPN/100 ml limit for water used for shellfish harvesting.

The median total coliform and fecal coliform densities are illustrated in the bar charts of Figure 5, and a line representing the shellfishing total coliform objective of 70 MPN/100 ml is shown near the bottom of the chart.

Median total coliform densities at all Wright River stations, ranging from 175 to 1,800, exceeded the 70 MPN/100 ml limit for oyster waters.

The median total coliform densities at 3 of the 4 new river sampling stations also exceeded the **allowable limit** for oyster harvesting.

Throughtout the August, 1963 survey, the total coliform densities in Calibogue Sound and the Cooper River remained consistently below the 70 MPN/100 ml standard.

Proportionate Effects of Sewage Discharges from Savannah Beach and the City of Savannah:

The proportionate effect of bacterial pollution from the city of Savannah and Savannah Beach, calculated from the hydraulic model dye study determinations, is shown on Figure

No. 6.

The shaded areas of the circles represent the percent of bacterial pollution attributed to sewage from the city of Savannah, and the clear areas represent the percent attributed to sewage from Savannah Beach.

Approximately 99 percent, or almost all of the bacteria from these two sources in the main channel and at Fields Cut came from the city of Savannah. Similarly, 94 percent of the residual 4.5 miles up the Wright River, and 85 percent at the mouth of the Wright River are also attributable to the city of Savannah discharges. This percentage is reduced near the mouth of the New River, where slightly more than one-half, or approximately 57 percent, is attributable to the city of Savannah, and approximately 43 percent is attributable to Savannah Beach. The results of this study indicate that the pollutional effects of sewage from the city of Savannah predominate, but that the unchlorinated effluent from the Savannah Beach sewage plant contributes significantly to bacterial pollution of limited areas of the South Carolina waters.

Areas Closed to Shellfishing

The areas closed to shellfishing are illustrated on Figure 7. The shaded areas show approximately the main river channels -- 11,000 acres, and portions of the adjacent tidal waters that have been closed to shellfish harvesting by the Georgia and South Carolina Health Departments. These waters were closed because of the potential health hazard to persons who might consume oysters which had accumulated bacteria from the raw and inadequately treated domestic sewage.

The South Carolina State Board of Health has condemned the areas described as "half of the Savannah River along South Carolina Shores, Mud Creek, Wright River, and unmarked creek to Tybee Roads, New River to above Ram's Horn Creek" for the taking of shellfish.

Bacterial pollution sewage, primarily from the City of Savannah and lesser amounts from Savannah Beach and other jurisdictions named in the report discharged to the Savannah River Estuary in Georgia causes a health hazard to persons who come in contact with the river, or who may consume oysters harvested from the estuary, in Georgia and South Carolina.

Oxygen Demand and Dissolved Oxygen:

In order to support fish and other aquatic life, water must contain dissolved oxygen. Estuaries are the nurseries of many important commercial fish and shellfish. Certain fish from the ocean, such as the American shad, pass up through estuaries to the fresh waters to spawn, and the juvenile fish return through these areas during their annual migration back to the ocean. Inadequate dissolved oxygen in a tidal river during the spring spawning run, or in late summer or ealy fall when the young are returning to the ocean, can reduce or eliminate the migration of these anadromous fish.

Most water pollution control agencies have adopted an average of 5 mg/l as the minimum DO that is adequate to maintain the maximum potential sport fish population. Neither Georgia nor South Carolina has adopted minimum DO standards for waters in the Savannah River Estuary. In other waters of the State that have been classified, South Carolina stipulates that the dissolved oxygen in class SC waters, used for crabbing and non-commercial fishing, shall not be less than 4 ppm.

The extent to which sewage and industrial wastes reduced the dissolved oxygen content of the Savannah River is illustrated on Figure 8. The shaded bars show the averages of all DO determinations and the continuous curved line passes through the minimum observed values. The 4.0 mg/l requirement for aquatic life is referenced by the horizontal line extending across the chart.

In the 6 mile reach of the Savannah River between th Atlantic Coastline Rail Road and the U. S. Highway 17 bridges, located above the sources of pollution, the dissolved oxygen content of the water, averaging 6.4 mg/l, was entirely adequate to support fish and aquatic life.

Before the river traveled another 6 miles, however, it was severely degraded by sewage and industrial wastes.

The average DO was reduced and remained below 4.0 mg/l for more than 16 miles from the City of Savannah to the start of the jetties at the Atlantic Ocean. The more critical minimum DO's were less than 4.0 for 20 miles.

The most seriously polluted reached extended 10 miles from the City of Savannah to Fields Cut where the minimum DO's were all below 1.0 mg/l. In fact, the DO neared zero with a minimum of o.1 mg/l in the South interstate waters near the mouth of the Back River channel.

The shaded portions of the circles in Figure 9 show the percentage of the samples that contained less than 4.0 mg/l of dissolved oxygen.

The DO was always below 4.0, throughout the entire three week survey, in the 2 mile reach near the confluence of the Front and Back River channels.

It was below 4.0 mg/l for more than half the time in the 14 mile reach from the City of Savannah to within two miles of the ocean.

Even at the mouth of the jetties, where the ocean waters are swept up into the River twice each day on the flood tides, the DO was reduced below 4.0 ppm for 25 percent of the time.

The survey data, illustrated on these Figures, revealed that oxygen demanding wastes; primarily from the Union Bag-Camp Paper Corporation and lesser amounts from the Continental Can Company, the City of Savannah and other sources named in the report; entering the Savannah River in Georgia polluted and reduced the dissolved oxygen content of waters in Georgia and South Carolina below the minimum requirements for the propagation of fish and other desireable aquatic life.

This completes the report itself and I think you wanted to call on Mr. Wastler and then I will come back to the Summary.

MR. STEIN: Do you need any adjustment for Mr. Wastler before the movie goes on?

MR. WEST: He can come right up.

MR. ROGERS: Mr. T. A. Wastler who is, as Mr. West mentioned, an oceanographer, is presently in charge of a special study over in Charleston Harbor.

During the time that these studies were being made on the Savannah Estuaries, Mr. Wastler was in charge of doing the work on a model that was set up over at Vicksburg for the Army Corps of Engineers. So Mr. Wastler is going to come up and narrate a film that we have for these studies.

Mr. Wastler.

MR. WASTLER: The studies which we did took about three weeks on the model. We have, I think, there are two or three of them that are illustrated in the film. In addition to this, we did some prototype work that is on the harbor itself. At the time there was some comment about our dumping about fifty pounds of dye out in the harbor. I think we colored the Corps of Engineers' tug or something but we did check the hydraulic model reports with prototype studies and they checked reasonably well.

We haven't tried to illustrate in the film the prototype studies actually.

All right, Paul. Maybe if we could turn off the overhead lights, if possible.

(Commencement of film.)

MR. WASTLER: This is not from the Savannah River.

We also have pictures of some of the outfalls in the location.

This is one of the industrial wastes. I believe that is paper mill waste.

This is the scum which is typical of both industrial and a good bit of sewage pollution. This is also a type of scum detergents cause. A number of other things cause it.

This is another industrial outfall in the area, and one more. This is obviously some different type of thing. One source of pollution that is not often commented upon is the garbage dump and trash dump near the edge of the water, both of which, of course, considerable seepage comes in that can't be attributed to anything.

This is a cooling water outfall and intact, I believe.

This is a submerged outfall. This is a shrimp boat going out. This is South Channel here. This is an outfall from Savannah Beach. It goes out pretty far but its usefulness is kind of damaged.

We have a study showing a release made at this point, some fishing and crabbing in the vicinity of it. Crabs seem to like sewage.

The first release was made right at the vicinity of the Tybee Outfall, made at high water slack right at this point, consisted merely of introducing some dye in the model.

Now, this is the model without water in it. The jetties are down here, New River, Wright River, Calibogue Sound, the close-up of the jetties. This is the North Channel, South Channel. This is the location of the Tybee Outfall. Savannah Beach. The close-up of the jetties. These are copper strips introduced in the mill and then verified experimentally. These are more copper strips into Calibogue to Tybee Sound. They reproduce the roughness of the bottom structure in the estuary.

We have made several releases, one at the lower industrial limit, one City of Savannah, upper industrial limit and Union Bag-Camp. This is the model filled with water and ready for operation. These structures are watertight measuring points so that the tidal characteristics are pretty closely reproduced in the model.

This is the tide machine consisting basically of a float and some timing devices so that the ocean tide is reproduced proportionately what it is in the ocean itself.

In the model the complete tide cycle was run eight minutes. You may notice this man moving, rather rapidly. That is because the film was speeded up about two to one. This is the dye being released at high water slack at approximately the location of Tybee Outfall. You notice that the dye is spreading out and heading down around Savannah Beach very close in shore. It also tends to spread a little bit upstream. Notice the streamer of dye moving right up the bottom like this.

Again each time he flips a card, that is equal to one hour on the prototype.

Observe that the dye is fairly well distributed out into the ocean and, of course, a shipping channel going along in here, a streak of dye heading up here, just generally here, staying in the vicinity of the outfall.

Now, this is just about low water slack tide. See the dye start to shoot back up the South Channel and come right up the bottom between the jetties and head right up North Channel. That is at the full extent on one tidal cycle, one excursion. The tide is already started to flood, going up the North Channel.

Notice the dye moving right straight across toward the mouth of the Wright and New Rivers heading up into South Channel. This is generally moving along the bottom now rather than on the surface. About at this time it started to move in the shores and that portion is so shallow that it gets fairly well mixed. A considerable amount of the dye also stays near the Savannah Beach area. Some has gone up the bottom of the New River, doesn't quite make it to the Wright River, doesn't quite make it to Calibogue Sound on one cycle excursion.

This particular release was made for the purposes of the film, one of the reasons being that we were sampling the area, we had the whole place pretty well stacked up with sampling stages. This is a close-up of the area, the jetties right up here and they will be the channels heading toward the mouth of Calibogue Sound.

This is after, I think it was three tidal cycles. See the dye is fairly well distributed over the entire area. That is just from the one release at the Tybee Outfall.

This is the Highway 17 bridge way above Savannah. The dye has penetrated. This is Front River, Middle River and I believe the Back River. The Seaboard Airline Bridge in the foreground and the Talmadge Bridge.

The next release is about at the vicinity of Bull Creek. It is an instantaneous release at about where the bulk of Savannah sewage enters the estuary. Notice some of the dye is moving upstream on bottom even while the top is going downstream. This is Talmadge Bridge. It has reached its full upstream extent right now. This was dropped at high water slack at the top. The bottom is still moving. The dye moves quite rapidly downstream. This is the confluence of Back River. The dye moves one side of the channel. This is South Channel. The dye splits. This is all on the first tidal excursion after the release. Now, South Channel, South Channel up here, the Elba Island Cut, Fields Cut right below this, there is Fields Cut.

Now, the tide has turned and the dye is going back upstream. It also enters the Wilmington River on this excursion. Little entering Back River. This is Highway 17 again. Seaboard Airline Railway. The dye is moving up both channels, Front River at the end of the tidal excursion. This is Highway 17.

On the next low water slack tide it goes all of the way down to the jetties. After that, Highway 17 Bridge. Almost up to it. Beyond it on Middle River.

You can see the dye from that particular instantaneous release is pretty well distributed. Ships also contribute some pollution.

These are some more outfalls which our camera man found interesting. Sometimes it is difficult to tell the mud from waste material.

Next we have a release at the upper industrial limit, right below Highway 17 Bridge, also dropped at high water slack. Again the cards indicate one hour intervals.

The dye moves quite rapidly downstream. Seaboard Airline Railroad Bridge. Talmadge Bridge down here. This is on the first tidal excursion after release. This is about where the center of the city is. Back River and the Savannah. It is just about at the turn of the tide now. It is heading back upstream. Here is the release point right here. Notice it is shooting back up Middle River in addition to Front River. This is after the second tidal cycle, after that release. The dye is pretty well gotten out into the ocean itself, over into -- It hasn't quite made it to Wright River. It is in New River and has gotten into Calibogue Sound.

These pictures were what happened when we made releases at all three locations. This is the installation of the tide gate for the sediment trap that the Corps of Engineers is considering. It made no noticeable difference in the overall distribution of pollution except to tend to move it more downstream. This is again with all three releases, one at the upper industrial limit, one at the lower industrial limit and one at the location of Union Bag. The dye gets over the entire model. This is Highway 17 Bridge, I believe, and this is once more some of the typical industrial waste outfalls. This, of course, is hard to tell whether it is industrial waste or detergents, from sewage.

(End of movie.)

MR. ROGERS: We will ask Mr. West if he will come back here and kind of summarize his report and interpretations.

MR. WEST: And now I will attempt to summarize the summary and conclusions of the report.

Water Uses:

The Savannah River Estuary is presently used for navigation, commerce, boating, industrial water supply and waste disposal.

In former years these waters also supported commercial fishing and shellfish harvesting.

Bacterial Pollution - Sources and Damages:

Raw and partially treated sewage, none of which is disinfected, polluted the Savannah River Estuary with sewage associated bacteria.

Raw sewage from about 108,000 persons in the City of Savannah was responsible for more than 80 percent, and partially treated sewage from Savannah Beach was responsible for 10 percent of the sewage associated bacteria discharged to the river.

Individual loads from the other jurisdictions, which in total discharged the remaining 10 percent of the bacterial load, are tabulated in the report.

These sewage discharges, from Georgia, increased the coliform and fecal coliform bacteria densities in the estuary beyond the maximum water quality criteria limits, resulted in the condemnation of shellfishing areas, and threatened the health of persons who may come in contact with the river water in Georgia and South Carolina.

Oxygen Demanding Pollution:

Industrial and sewage discharges polluted the Savannah River with oxygen-demanding wastes.

Wastes from the Union Bag-Camp Paper Corporation, containing about 810,000 population equivalents, was responsible for about 70 percent, wastes from the Continental Can Company, containing 130,000 population equivalents was responsible for 11 percent, and raw sewage from the 108,000 sewered population in the City of Savannah was responsible for 9 percent of the oxygen-demanding material discharged to the river.

Individual loads from the other sources, which in total discharged the remaining 10 percent, are tabulated in the report.

These oxygen-demanding waste discharges from Georgia reduced the dissolved oxygen content of river water below levels considered adequate to support a well balanced population of fish and desirable aquatic life in Georgia and South Carolina.

At one time commercial fishermen fished in the Savannah River extensively for the American Shad. It is reported that in recent years the flesh of the fish caught in this area was tainted with objectionable tastes and commercial buyers were reluctant to handle Savannah River fish. The commercial fishermen gradually moved to other fishing areas and the Savannah River no longer supports a commercial Shad fishery.

Conclusion:

Sewage and industrial wastes discharged to the Savannah River from Georgia cause pollution of the interstate waters in the Savannah River Estuary, which endangers the health or welfare of persons in Georgia and South Carolina, and therefore is subject to abatement under the provisions of the Federal Water Pollution Control Act.

(Continued on next page.)

And this is the end of the report.

MR. STEIN: Are there any comments or questions?

(No response.)

MR. STEIN: Thank you very much for your very comprehensive report.

Mr. Rogers, do you have anything else?

MR. ROGERS: Mr. J. David Clem, who is with the Public Health Service in Atlanta, Georgia, has a statement prepared regarding shellfishing in the Savannah Estuary, and along with him is Mr. Roger Hammerstram, who is in charge of shellfish research, so he is available for questions.

MR. CLEM: Mr. Chairman, Conferees, ladies and gentlemen, I would like to enter this statement here as a matter of record. I will read all of it.

My name is David Clem. I am a sanitary engineer and Regional Shellfish Sanitation Consultant, Division of Environmental Engineering and Food Protection, Public Health Service in Atlanta. The statement I wish to present concerns the interest the National Shellfish Sanitation Program has for harvesting of oysters, clams and mussels from clean waters and the prevention and abatement of water pollution. Georgia and South Carolina, along with 21 other States, the shellfish industry, Canada, Japan, and the Public Health Service are all participants in this program.

The principles and procedures of this program were developed 40 years ago because of a large outbreak of typhoid fever caused by eating infected oysters which were sold in seven States.(1) Today the basic principles of the program remain much the same. A brief look at some of the responsibilities and administrative procedures for the certification of interstate shellfish shippers may provide a better understanding for future discussions.

Each State is held responsible for making sanitary surveys of shellfish growing areas, classifying suitable waters for the direct marketing of shellfish, control of harvesting practices, sanitation of shellfish plants and shippers and their certification. Approved growing areas for the direct marketing of oysters and clams must have a sanitary survey prior to classification. This survey must offer evidence that pathogenic bacteria, radionuclides, pesticides and harmful industrial wastes do not reach approved areas in dangerous concentrations. The median Coliform MPN of the water must not exceed an MPN of 230 per 100 ml.(2) This was eluded to in the film. Standards used in the program have been jointly developed over a long period by the States and the Public Health Service with the co-operation of the shellfish industry.

The Public Health Service annually endorses each State program that meets the recommended standards of the co-operative program. Currently both Georgia and South Carolina are endorsed by the Public Health Service. Twice a month the Public Health

Service publishes a list of all certified interstate shellfish shippers.

Historically, shellfish-borne outbreaks of typhoid fever and infectious hepatitis due to the consumption of raw shellfish have been caused by some form of water pollution. A severe neurologic disorder among 83 persons was recognized in Japan in 1953. The cause was due to a vinyl chloride plant discharging industrial waste to an estuary. Fish and shellfish eaten by the cases were found to contain toxic amounts of mercury.(3) The sanitary control of the approved growing areas is one of the most important concepts in the program. Likewise the prevention of harvesting oysters from polluted areas is an important control.

Oysters reflect the water quality from which they were harvested. The oyster is an efficient filter feeder concentrating particulate matter and other minute constituents from estuarine water. One investigator has observed that some oysters contained up to 3.5 to 4.0 percent zinc while the overlying waters contained not over 0.02 ppm.(5) This represents a concentration-retention factor of 175,000 to 1. Microbiological organisms are accumulated in a similar way as shown -- we have figures of the oyster (Crassostrea virginica) coliforms, which are found in the Savannah harbor and the coliform values that are contained in the oyster meat are, generally speaking, always higher than that found in the overlying waters.

TABLE I. Level of Water Coliforms to Oyster (Crassostrea virginica) Coliforms.

Location	Water Coliform Median MPN/100 ml.	Oyster Coliform Median MPN/100 mg.
Apalachicola Bay,* Florida	25	380
Bon Secour Bay,* Alabama	5.9	130
Mississippi Sound,* Mississippi	190	1,000
do	43	540
Massachusetts** (laboratory)	20	130
do	70	450
do	700	4,700

* Reference No. 6

** Reference No. 7

Because of the propensity of oysters to concentrate organisms and particulate matter from its surrounding waters and because the public continues to enjoy eating the whole animal raw, it is imperative that they be harvested from clean waters.

In the report presented today it is stated that 11,000 acres of coastal waters in the Savannah area are closed to harvesting shellfish. This is referred to in the red area delineated on this map here. This degradation of water quality has a four-fold impact on the shellfish industry and control officials: 1) loss of a natural resource, 2) patrol and jurisdictional difficulties, 3) sanitary surveillance requirements, and 4) sports-harvesting and consumer confidence considerations.

At the 1964 National Shellfish Sanitation Workshop it was reemphasized and unanimously endorsed that shellfish are a renewable, manageable natural resource and that shellfish culture and harvesting represents a beneficial use of estuarine water. The decline of the oyster industry in both Georgia and South Carolina has been quite apparent since 1908. In that year South Carolina produced 7,440,000 pounds of oysters. In 1963 the production had decreased to 3,830,000 pounds of which 51.7 percent was from Beaufort County waters. In the corresponding period, Georgia's production has dropped from 8,070,000 pounds to 235,000 pounds. In 1963, 43.3 percent of Georgia's production was from the waters of Chatham County.(4) This decline of the oyster industry may have been due to several factors; pollution, including sedimentation; failure to repopulate; predators; adverse ecological conditions; and a reduced market for the product.

The patrol of waters classified as prohibited is a necessary control function that is a by-product of pollution. Keeping the public and oysterman posted as to where approved waters are located is another responsibility of the States. Surreptitious oyster harvesting from polluted areas must be prevented in order to ensure that a safe product reaches the market. Also a troublesome control to officials on interstate waters is the problem of apprehending persons who have harvested oysters from polluted waters in an adjacent State.

The third by-product of pollution is the need for sanitary surveillance of waters adjacent to approved waters in order to determine changes in microbiological and chemical concentrations. Savannah, like other coastal communities, is experiencing a population growth and industrial expansion. The effect of this urbanization as a contributory factor to the closing of the main river channels and a portion of the adjacent tidal waters to shellfish harvesting by the Georgia and South Carolina Health Departments is apparent in the report presented today.

The sportsman who gathers oysters and is not aware of the water quality in this estuary runs the risk of becoming infected or infecting others with typhoid fever, infectious hepatitis, or other enteric disorders. Incidents of this sort cast suspicion even on certified oysters and lowers consumer confidence in the product.

As a spokesman for the co-operative program, I wish to leave you with these points for your consideration: -- That;

1) Oysters, clams and mussels are a renewable, manageable natural resource of significant economic value to many coastal communities.

2) The multiple utilization of estuaries and pollution preventation and abatement programs should recognize that shellfish culture and harvesting represents a beneficial use of estuarine waters.

3) The National Shellfish Sanitation Program actively encourages water quality programs which will preserve all possible coastal areas for this beneficial use.

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MR. STEIN: I thank you, Mr. Clem. Your bibliography and the tables, without objection, will appear in the record and I would like to call attention to your remark about the red markings on the map. As you know, the report and transcript will be completed in black and white and I think an appropriate point is that we could parenthetically indicate the kind of hatching that will be represented by the area that you refer to as the name of the mouth, the mouth of the Savannah River, so that people will be able to refer to that.

I would appreciate it if in the future, references were not made to color, because this color will not be reproduced in the report and it gets a little confusing sometimes.

Are there any questions or comments on the report?

MR. HOWARD: I would like to ask Mr. Clem if he has any reproduction figures in the shellfishing in the Savannah estuary prior to this.

He mentioned Beaufort but not the Savannah River.

MR. CLEM: The statistics that I quoted came from the Fish and Wildlife Service and theoretically they are landings by county only and we do not have any breakdown to the Savannah River estuary specifically.

MR. STEIN: Are there any further questions or comments?

(No response.)

MR. STEIN: If not, thank you very much, Mr. Clem.

Mr. Rogers?

MR. ROGERS: We have several other Federal agencies that are represented here, but I believe you have only one other that is to make a statement. We have Colonel Ramee, who is the District Engineer here for the Savannah District for the Corps of Engineers.

Colonel Ramee, will you come up?

COLONEL RAMEE: I am Paul W. Ramee, the District Engineer, U. S. Army Engineers, District of Savannah.

The purpose of making my statement is to make clear the Corps of Engineers' interest in this particular area we are discussing.

The Congress of the United States has assigned the duty to the Department of the Army responsibility for protection and preservation of navigable waters. The Corps of Engineers discharges this responsibility for the Secretary of the Army and responsibility includes the enforcement of laws prohibiting the pollution of navigable waters by oil and the prevention of injurious deposits that affect navigation.

Control of other types of pollution is the responsibility of the local state, county and other local and Federal agencies.

Now, while the Corps of Engineers has the sort of responsibility that I just described, we nonetheless have a vital interest in the improvement, development and more effective utilization of all navigable waterways and an example of our interest has been the contribution of the Waterways Experimental

Station and the model studies and which you have different pictures of. These tests were made on a model developed for navigation purposes but readily adaptable to the uses which you saw. And the studies were jointly conducted by the Health, Education, and Welfare personnel and the Waterways Experimental Station personnel.

In conclusion, I wish to state that the Corps of Engineers will continue to cooperate with the appropriate agencies concerned in doing its part toward developing and implementing plans for pollution abatement in the Savannah Harbor and any other navigable waterway that might be so concerned. Thank you

MR. STEIN: Thank you, Colonel.

Are there any comments or questions?

(No response.)

MR. STEIN: Mr. Rogers?

MR. ROGERS: We have several pieces of correspondence from other interested Federal departments and agencies. I would like to read one paragraph here from the Department of the Air Force.

MR. STEIN: Mr. Rogers, I suggest when you read a paragraph from the relatively short letter, we put the whole letter in for the record, if that is agreeable with you.

MR. ROGERS: Dated 27 January, 1965, from the Department of the Air Force, Headquarters, United States Air Force, Washington, D. C., addressed to me as Regional Program Director.

"Dear Mr. Rogers:

"Reference is made to your letter of 4 January 1965 regarding the conference on Water Pollution.

"We appreciate very much your invitation to participate in the conference on alleged interstate pollution of the lower 28 miles of Savannah River. Second Lieutenant George W. Sieber, the bioenvironmental engineer, 1710 U.S.A.F. Hospital, Hunter Air Force Base, Georgia, will attend the conference, however, no statement will be presented.

"U.S.A.F. Medical Service Bioenvironmental Engineers have participated with USPHS, State and local water pollution control authorities in surveying the waste disposal practices at Air Force installations, the type of water pollution abatement was one of the major topics of the annual USAF bioenvironmental engineering symposiums and we are most anxious to work with other agencies concerned with water pollution abatement.

"Sincerely, Alvin F. Meyer, Junior, Colonel, USAF MSC."

MR. ROGERS: We have several other people here. I might just ask if they have a statement. There is no indication that they would have one.

Major Bill B. Wilson, Assistant Base Civil Engineer, Hunter Air Force Base. Is he here?

A VOICE: Mr. Wilson isn't here

MR. ROGERS: A. D. Barbee, Chief Engineer over at Hunter Air Force Base. Do you have a statement?

MR. BARBIN: No.

MR. ROGERS: Mr. A. Wilson White, Southern Piedmont Conservation Research Center, Department of Agriculture.

MR. WHITE: No statement.

MR. ROGERS: Mr. Ross Buck, Chief Facilities Planning Office for Communicable Disease Center.

MR. BUCK: We have no statement.

MR. ROGERS: Are there any other Federal Agencies represented that would like to make a statement?

(No response.)

MR. ROGERS: Mr. Chairman, this concludes our Federal presentation.

MR. STEIN: Thank you, Mr. Rogers.

At this point I think we may recess to stretch for ten minutes, but before we do, I would like to indicate what I see the time schedule is, so you will have some forewarning.

I suspect that both states' presentations should be completed hopefully before 1:00 o'clock or by 1:00. Now, if that happens, we will adjourn or recess at that time from 1:00 to 3:00 and at 3:00 o'clock reconvene and then we will go into the discussions and the Summary.

At the present time we will stand recessed for ten minutes.

(Short recess).

MR. STEIN: May we reconvene at this point? We will call on Mr. Linton of South Carolina.

Mr. Linton.

MR. LINTON: Mr. Chairman, fellow conferees, ladies and gentlemen, my name is W. T. Linton. I am Administrator of the Water Pollution Control Authority in South Carolina and Director of the Division of Sanitary Engineers of the State Board of Health in the same state.

I am exceedingly pleased to be here in connection with a matter of this kind. I glory in the procedure which is set here. I thank God daily for the opportunity to sit down and discuss mutual problems with interested people and I assure you that insofar as the contributions of the State of South Carolina are concerned to the solution of the problem that I feel very much like the gentleman who went into a shipyard and asked the first man he came to what he was doing. This man says, "I am making a living."

He asked the second man to whom he addressed the question, "What are you doing?"

"I am bradding a rivet."

He asked the third man what he was doing. He says, "I am building a battle ship."

Ladies and gentlemen, we are building an empire, an empire which is a credit to the generation and a mechanism for the survival of the future generations and they will be the determinates which I contribute to the solution of the problem confronting all of us today.

This is no easy matter. Pollution is a relative thing. Its control costs millions of dollars. The deprivations referred here to today, are they mentioned in dollars? If this is the guideline, there should be given some consideration to the remedial measures dimensioning by the same factors.

I wish now to say to the representatives of the United States Public Health Service that I consider the report which has been made and presented here a very fair document, documented by valid philosophy and I am sure representative of conditions which I would dare not take issue with.

Therefore, I say that the record should show that the document presented by the United States Public Health Service is a substantial document representing conditions as they exist, unprejudiced and unbiased and certainly for the determination to be made here, are a substantial contribution.

In an effort to abbreviate as far as possible the procedures of this -- not a hearing. What is it?

MR. STEIN: Conference.

MR. LINTON: Conference. I have asked two members of the South Carolina Government, one who works for me and one who works for the Commercial Fisheries Division of the Fish and Wildlife Service of South Carolina to make a statement which may or may not document some of the information which or may not document some of the information which you have heard. However, I wish now to indicate that I in no way influenced the information contained in these reports.

These reports are based upon facts insofar as they can be presented and they are the products of the gentlemen's efforts and experience and the operations which they themselves fictitionally -- functionally operate. (Laughter).

Well, I am glad you all enjoyed it. I didn't think it was cute. (laughter.)

So, to get the proceedings underway, I would like to call on a representative of the Sanitary Engineering Division, Mr. Somers Pringle who is in charge of the shellfish program in South Carolina to present to us his estimate of the degradation of the oyster or shellfish bearing waters of the State of South Carolina imposed on by the pollution indicated there.

MR. PRINGLE: Thank you, Mr. Linton.

Mr. Chairman, my name is Somers Pringle. I am Chief of the Shellfish Section, Division of Sanitary Engineering, South Carolina State Board of Health and Administrator Beaufort-Jasper Counties, South Carolina.

The Shellfish Section was not designated as a separate section of the Division of Sanitary Engineering until August 1957, prior to that time, it was a segment of the Milk and Food Section.

During the late 1920's and early 1930's, some bacteriological analyses of oyster-bearing waters were performed by Weston & Weston, due to the Thyphoid outbreak in Chicago, about 1925-1926, which, I assume, laid at the door of raw shucked oysters.

From data gathered at that time -- records which are not now available -- the area southward of the Daufuskie Island landing was closed to commercial gathering of oysters. Spot check sampling of oyster bearing waters in 1946 showed apparently no further increase in the polluted area. In 1957 spot checks to determine if the pollution had increased or progressed further into open areas now put the upper limits of the polluted area of the northern entrance of Ram's Horn Creek.

The fact that the area of tidal waters, as shown in red on the submitted section of C. & G. S. Chart 1240 -- There is a differentiation in colors. I will say the area as marked was polluted with a median of more than 70 per 100 ml.

In view of the fact that in 1959 - 1960 it became necessary under the Shellfish Program to prove all open or approved waters were within limits of a median lower than 70 per 100 ml, all closed areas were regarded as disapparoved and laboratory efforts were so concentrated.

During May 1963, a series of five samples were collected at the stations on Section 19, in the same area as given on the reports, Stations 19 through 20, as designated on the chart and median results are listed on Page "A", included in this report.

During the spring of 1964, float tests were made from Bloody Point in Calibogue Sound to gain some knowledge as to how up-stream the flood tidal flow would penetrate into May River and Skull Creek, this is shown on the chart by an arrowed line, the other lines showing leased oyster beds in the area of the flood flow that could be affected should the area of pollution increase from return waters at the mouth of Calibogue Sound. On the chart this shows that much of it reaches up in the mouth of the river.

The Shellfish Section of South Carolina has constantly been fearful of the possibility of a break-through across the marshes north of Fields Cut into the upper reaches of Wright and New River, as shown by curved arrowed line. During January 1965, a series of three samples were collected at all stations in Section 19 and the results of these analyses are shown on Page "B" of this report, a hasty conclusion might assume that some break-through had occurred around stations number 13, 14, 15, and 16.

The Shellfish Section has no jurisdiction in the economics involved or the knowledge thereof, this being within the premise of the Division of Commercial Fisheries; however, each and every mile or additional miles of closed area places a heavy burden on the Section to patrol in order to prevent polluted shellfish from endangering the health of the citizens of the United States.

(Continued on next page.)

PAGE "A"

Section of 19, area as shown on portion of C. & G.S. Chart 1240.

STATION	DATE	MEDIAN
1	Less than 70 - 100 ML	
2	9.1	
3	43	
4	9.1	
5	9.1	
6	15	
7	7.3	
8	3.6	
9	9.1	
10	3.6	
11	6.0	Red water
12	23	Red Water
14	150	
15	93	
16	75	
17	460	
18	1100 plus Fields Cut	
19	240	
20	210	

PAGE "B"

Section 19, areas as shown on portion of C. G.S. Chart 1240

STATION	DATE		
	1/9/65	1/12/65	1/13/65
	100 Per ML		
11	23	23	23
12	20	43	7.2
13	240	43	93
14	240	75	240
15	93	93	240
16	150	93	93
16A	43	23	460
17	1100 plus	460	150
17A	1100 plus	93	150 Docks
18		1100 plus	1100 plus
19		1100 plus	460
20	240	1100	460

SHELLFISH SECTION - DIVISION OF SANITARY ENGINEERING
SOUTH CAROLINA STATE BOARD OF HEALTH

LEGEND OF SECTION OF C. & G.S. CHART 1240

SOLID RED LINE AREA , shows waters within the State of South Carolina now closed to the gathering of shellfish for any purpose.

SOLID BLUE LINE , shows oyster beds now under lease to the Industry by the Division of Commercial Fisheries of South Carolina.

ARROWED RED LINE , shows tidal flow study on flood tide by float test made starting at Bloody Point, Calibogue Sound.

CIRCLE RED LINE , potential break through to open oyster waters.

Compiled by Division of Commercial Fisheries and
Shellfish Section, S C State Board of Health

LEGEND

CHART SECTION 9

RE: C. & G.S. 1240

Heavy Black line denotes un-approved (closed area

XXXX line denotes oyster leases in open waters.

Arrowed line denotes flaot test on Flood tide starting at Bloody Point.

Flag denotes sampling stations.

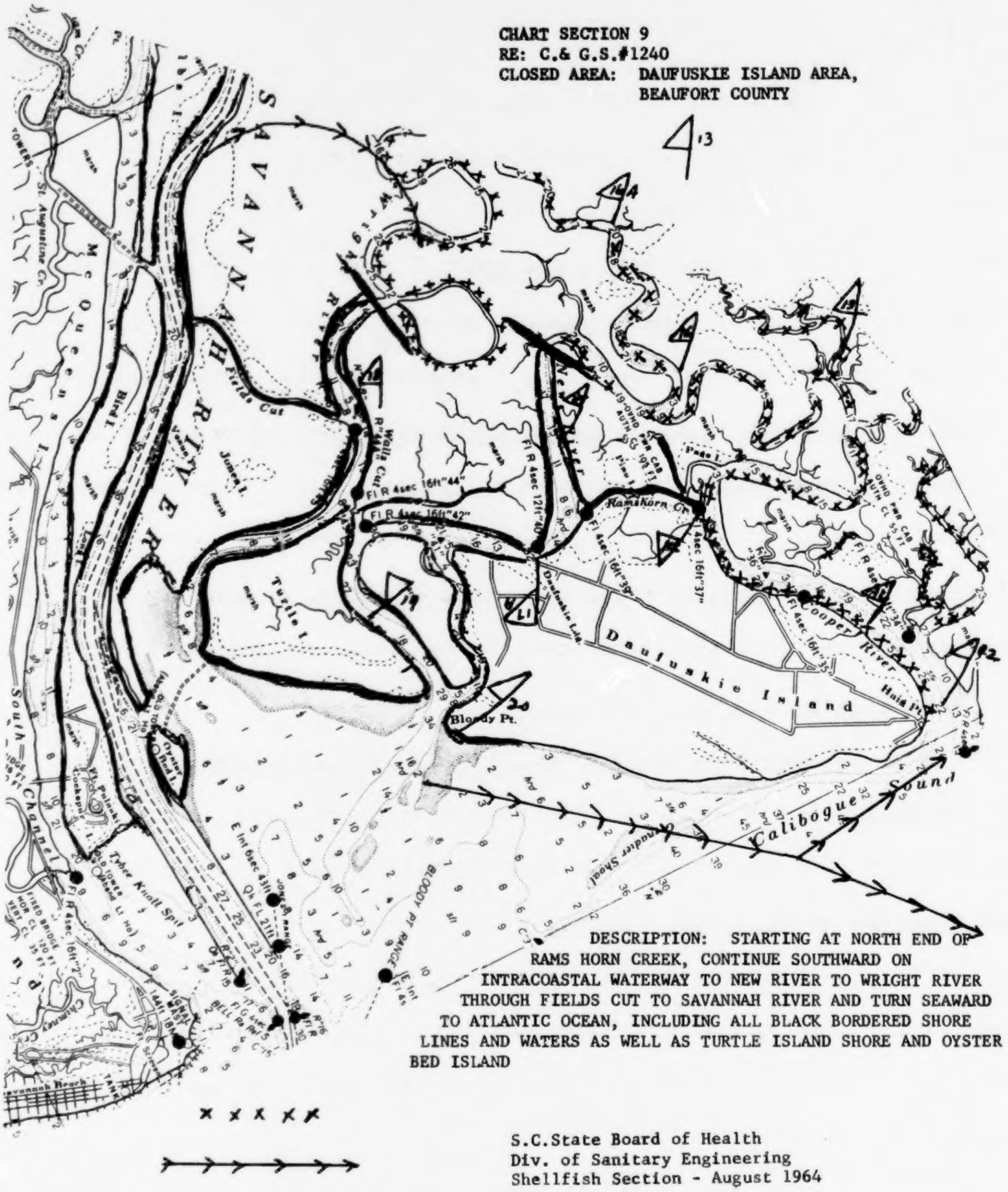
Curved arrowed line denotes break through over marshes north of Field Cut.

Compiled by Shellfish Section

Reproduced from
best available copy.

CHART SECTION 9
RE: C.& G.S.#1240
CLOSED AREA: DAUFUSKIE ISLAND AREA,
BEAUFORT COUNTY

4'13


SAVANNAH RIVER
Wright River
New River
Fields Cut
Walls Cut
Turtle I.
Ramshorn Cr.
Pope I.
Cooper River
Haig Pt.
Daufuskie Island
Bloody Pt.
Calibogue Sound
McQueens I.
St. Augustine Cr.
Bird I.
Jones I.
Oyster Bed I.
South Channel
Tybee Knoll Spit
BLOODY PT RANGE
Savannah Beach
Fl R 4sec 16ft "44"
Fl R 4sec 16ft "42"
Fl R 4sec 12ft "40"
Fl 4sec 16ft "37"
19
20
21
22
X X X X X

DESCRIPTION: STARTING AT NORTH END OF RAMS HORN CREEK, CONTINUE SOUTHWARD ON INTRACOASTAL WATERWAY TO NEW RIVER TO WRIGHT RIVER THROUGH FIELDS CUT TO SAVANNAH RIVER AND TURN SEAWARD TO ATLANTIC OCEAN, INCLUDING ALL BLACK BORDERED SHORE LINES AND WATERS AS WELL AS TURTLE ISLAND SHORE AND OYSTER BED ISLAND

S.C.State Board of Health
Div. of Sanitary Engineering
Shellfish Section - August 1964

MR. STEIN: Thank you, Mr. Pringle.

Are there any comments or questions?

(No response.)

MR. LINTON: Mr. Chairman, I have a report here from Mr. -- from Dr. G. Robert Lunz, Director of the Division of Commercial Fisheries, South Carolina Wildlife Resources Department, and I wish to indicate to you that he had proposed to be here but because of the urgency of the legislative requirements that attended his budget, he must be in Columbia to defend himself before the Budget and Control Board today and try to justify the recommendations that he has made request of funds for.

With your permission, I will read this and give you a copy for the record. I think there are some good points in here that are worthy of your consideration, that is, yours and mine, and Mr. Stein's.

This report was prepared in connection with the normal operations of Dr. Lunz and Bears Bluff Laboratories in which he keeps a running invertory of the shellfish in South Carolina, and certain other fish.

COMMENTS ON THE POLLUTION OF SOUTH CAROLINA MARINE WATERS IN THE SAVANNAH RIVER BASIN AREA

By: G. Robert Lunz, Director South Carolina Wildlife Resources Department, Bears Bluff Laboratories and Division of Commercial Fisheries.

Potential value of polluted oyster grounds:

The oyster grounds in the Wright River, New River, Ramshorn Creek, and in the vicinity of Turtle Island and Daufuskie Island, have long been closed to commercial oystering because of pollution allegedly emanating from the Savannah River. There are no records at Bears Bluff Laboratories or at the Division of Commercial Fisheries to show just when this area was first closed to oystering by the South Carolina Board of Health. Doubtless the State Board of Health will testify as to this date.

I cannot do so because it is beyond the limits of my knowledge.

From memory commercial oystering was prohibited in Wright River, New River and Ramshorn Creek at least as early as 1948. "An investigation of the Coast Waters of South Carolino with Reference to Oyster Culture" by John D. Battle, published in the Bulletin of the U.S. Fish Commission, Vol. 10, for 1890, reports on a study made on parts of the South Carolina portion of the Savannah River Basin. The report comments on the great amount of mud in suspension in the waters of the Wright River and New River received from the Savannah River. Despite this, the report notes the findings of large deep shell oysters in good condition growing subtidally in the area, and also notes that oyster boats were tonging similar oysters in deep water there. Hearsay evidence, and this is funny kind of but this is the kind that he refers to. Hearsay evidence indicates that in the late 1800s a large oyster plant was situated on Daufuskie Island which employed more than 100 persons. Some of these oysters used in this plant came from the Wright River and Ramshorn Creek.

A brief survey of the area made in August 1959 by a staff member of Bears Bluff Laboratories, showed that the intertidal oysters were in rather poor condition, with a high mortality rate, and quite sparse. No evidence of cultivation of shell planting was observed, and the estimate was that the entire population including all sizes was probably less than 8,000 bushels of oysters in this area at that time. Now, that is not many oysters.

Subsequently, the Division of Commercial Fisheries encouraged the movement of oysters from polluted areas for relaying, and fairly large quantities of hitherto wasted oysters were removed from the Santee River. None was knowingly removed from the Wright River, New River, or any of the polluted areas adjacent to the Savannah River. The success, from the oysterman's point of view, of the Santee River movement encouraged leasing of the South Carolina portion of the Savannah River Basin. Sixty-three and six tenth acres of oyster lands were leased in this area. This is included on a map which is in the appendix. However, in 1962, the South Carolina State Board of Health found it was unable to properly supervise the relaying of oysters, and the practice was discontinued in the State."

This ought to prove to you that I had nothing to do with the preparation of this report because he is needling us right here and it is not quite right because the South Carolina State Board of Health does allow the relaying of oysters, but not in the marketing season of oysters, so, make that as a correction.

MR. STEIN: Maybe that is one of those figments.

(Laughter.)

MR. LINTON: "The oyster lease in the New and Wright Rivers was abandoned.

Because over the years the area was not properly cultivated by oystermen due to pollution, the productivity has been reduced. Based on the average production of other leased beds in unpolluted areas in the State of South Carolina, the 63.3 acre lease would ordinarily have produced between 6,000 and 8,000 South Carolina bushels annually." The South Carolina bushel is 89.3 percent larger than a U. S. standard bushel measure. I want you to tell Celebrezze that. "The present price of seed oysters is not known, but seed oysters such as could normally have been produced in the New and Wright Rivers two years ago, were worth about 68 cents a South Carolina bushel f.o.b. the oyster beds. Thus, the seed oysters which could have been grown and marketed from the areas if it were unpolluted, would have been worth between $4,000 and $5,000 annually to the leaseholder.

I make almost that much.

No information is presently available as to the quantity or quality of the subtidal oysters in the Wright and New Rivers. This class of oysters would, of course, be much more valuable. South Carolina leases do not include subtidal oysters. Leases extend only to 1 foot below low water mark.

If the Wright and New Rivers could be declared suitable waters for the cultivation of oysters, the State could again lease the 60-odd acres."

And I think there were some revelations here a few minutes ago of several thousands of acres of land that could be used for oyster fishing but in South Carolina the leases are limited as described here and he estimates 60 acres.

"With proper management and planting practices this acreage would certainly be increased. The return to the oyster industry, and to the State in the form of direct rentals and taxes, would be significant.

If these oyster grounds had not been polluted and had been continuously open since their closure in 1948 -- assuming no change in price structure -- South Carolina oystermen would have harvested $ 64,000 to $ 90,000 worth of oysters.

And I don't make nearly that much.

Pollution Extended and Value:

Dye studies in South Carolina portion of the Savannah River Basin indicate the possibility of pollution spreading beyond the closed area into the Cooper River and Calibogue Sound.

("Report on Pollution of Interstate Waters of the Mouth of the Savannah River, Georgia - South Carolina", by the U. S. Department of Health, Education, and Welfare, Public Health Service, dated November 1964.) "

Now, he here refers to the dye studies in the South Carolina portion of the Savannah River Basin. He indicates the possibility of pollution spreading beyond the closed areas into the Cooper River and Calibogue Sound.

"If this were to happen,,over 400 acres of oyster grounds, comprising parts of seven oyster leases presumably would be closed. As small as this 400 acres is, this would represent about 6 per cent of all the total leased acreage in the State of South Carolina. Based on general knowledge of this State's oyster production a conservative estimate of the volume of oysters which could be taken from this area would be in the vicinity of 50,000 bushels annually. The ex-vessel price of these oysters, because of their generally good quality, would be $1.00 a bushel. Thus, the spread of pollution into the Cooper River and Calibogue Sound would probably curtail the monetary return to oystermen leasing the areas by $50,000. In ordinary broad calculations of fisheries value, ex-vessel price can be multiplied by 3 to give the wholesale value of a fishery resource. Thus the present closed areas, plus additional areas if pollution follows the dye test indications, would cost the lower part of coastal South Carolina some $180,000 annually. These estimates of value are confirmed by Fisheries Statistics of the United

States, 1962, Statistical Digest No. 56, U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, which gives the ex-vessel price of South Carolina oysters as being $1,168,000 for all the oysters produced in the State."

I am going to repeat this, and this is documentary information from the official publication of the United States Government indicating that the total value to oystermen for oysters gathered in South Carolina during one year was $1,168,000.

"In this State practically all oysters are produced on bottoms leased from the State. There are 7,000 acres under lease. Thus each acre nets an annual ex-vessel return of $167. The 460 odd acres in the Savannah River Basin on the South Carolina side which are already polluted or are threatened with pollution then produce about $76,820 annually, **ex-vessel** price or $220,000 wholesale value. This value is not greatly different from the more conservative figure given above and obtained by different calculations.

In the Fisheries Resources of the United States, Senate Document No. 51, 77th Congress, published in 1954, in arriving at the total capitalization value of fisheries resources the author takes the value of the fisheries and calculates how much money invested at 4 per cent per annum would be required to yield this value. Following that formula, the presently polluted area has an investment value to the State of South Carolina of between $450,000 to $600,000. If the pollution spreads, as as indicated by dye studies, the investment value would approach $5,000,000."

Here is a comment made by Dr. Lunz referring to the shad fishing industry, and I would like for you to give some consideration to what he says here.

" Shad Fishery in the Savannah River:

The Public Health Service report mentioned above, dated November 1964 notes on page 12 that the Savannah River no longer supports a shad fishery. This seems to be in error."

This is Dr. Lunz, not me. I wouldn't dare test that report.

"Although the Division of Commercial Fisheries does not have landing statistics for the shad from the South Carolina side of the Savannah River, licenses were issued for 64 gill nets to be used in the Savannah River during the shad season of 1964.

And that, I am sure, can be documented and substantiated by copies of these licenses.

No doubt, with accurate information available, the shad fishery in the Savannah River Basin would show a decline during the past 60 or more years, but the State of South Carolina does not have information which would support the statement made by the Public Health Service on page 12 of its report that the Savannah River no longer supports a shad fishery.

Information for Further Study Available:

Since 1953, Bears Bluff Laboratories has been keeping a continuous inventory of the fishes, crabs and shrimps throughout the greater part of South Carolina by monthly -- and often more frequent -- experimental tows with an otter trawl."

If you all know what this is, I don't. It has got something to do with a drag behind a boat, I understand.

"Additionally, but by the same methods, rather extensive work was done in the Calibogue Sound in 1957 and 1958. In the regular state-wide survey, two of the stations were in the areas which can be included in the Savannah River Basin. One of these, designated as "Bloody Point," is located between the mouth of Calibogue Sound and Tybee Roads, a few miles offshore of Daufuskie and Turtle Islands. The other is located in the upper end of Calibogue near a marsh island across from Bram Point. At these two stations, since 1953, considerable data has been accumulated. Specimen data sheets with the type of information on file at Bears Bluff Laboratories are attached in the Appendix.

Unfortunately, the Laboratories has neither the personnel nor the appropriations to make a special study of this long-time inventory. If this were possible, and these data were compared with similar information available for unpolluted areas with comparable hydrographic conditions in the State of South Carolina, more definite information might be obtained on the effects of pollution from the Savannah River on South Carolina fisheries."

Drag: # 2

Bloody Point

Date July 29, 1964

SHRIMP

P. setiferus

Size Inch	Totals No.	Ounces H. off	Count
2-3			
3-4			
4-4.5			
4.5-5			
5-6			
6-7			
7-8			
Sum			

..........oz. Sample/Entire Catch/Used.

Total Catch: H. off..........lb. ....oz. F..........

P. aztecus

Size Inch	Totals No.	Ounces H. off	Count
2-3			
3-4			
4-4.5			
4.5-5	4	1	
5-6	49	20¼	
6-7	8	5	
7-8			
Sum	61	26¼	

40 oz. Sample/Entire Catch/Used.

Total Catch: H. off 1 lb. 10¼ oz. F 1

P. duorarum

Size Inch	Totals No.	Ounces H. off	Count

..........oz. Sample/Entire Catch/Used.

Total Catch: H. off..........lb. ....oz. F..........

CRABS

C. sapidus	0-1	1-2	2-3	3-4	4-5	5 & over No.	Dom. Size	Totals No.	Ounces
Immature Males									
Immature Females					1			1	4
Mature Males						5	6¼	5	32
Mature Females						11	5¾	11	63
Sponged						13	6	13	93

T.L., mms.

C. regalis: 90,108,105,114,111,114,120,83,125,75.

Spot: 117,123,135,115,135,137,140,153.

Menticirrhus americanus: 228,232,260,268.

Croaker: 105,115,113,123,115,115,117,115,112,
114,123,127,130,136,142,157,174.

Northern Fluke: 157

Star Drum: 62,64,68,70,68,69,87.

Orthopristis chrysopterus: 104,104,107,109,112,113,113,118,
122,125,127.

Prionotus scitulus scitulus: 100-105 dom. (90%)

BEARS BLUFF LABORATORIES—WADMALAW ISLAND, S. C

Burlougs-14766—7-64.

Drag: # 2 Location: Bloody Point Net: 20' Flat Date: July 29, 1964

Net Over: 4:13P.M. Net Up: 4:33P.M Bottom: Mxsnd Water Depth: 12-18' Tide: Low Ebb Air Temp: 29.0°C Water Temp: S. 28.5°C B. 28.0°C

Surface Salinity 21.1°/oo

Bottom Salinty: 22.9°/oo Turbidity Mod. High Wind: S E 10-20mph (......) Sea: Choppy Weather: Overcast

Speed 700 rpm. With/ ~~Against/ No~~/ Tide ~~Up/ Down/ Creek.~~ Seaward/ ~~Landward/ Coastwise~~

COMMERCIAL FISH

Size in inches

Species	0-3 No.	0-3 Oz.	3-6 No.	3-6 Oz.	6-9 No.	6-9 Oz.	9-11 No.	9-11 Oz.	Over Size No.	Over Size	Over Size Oz.	Illegal No.	Illegal Oz.	Legal No.	Legal Oz.	Size with Roe No.	Size with Roe Min.	Size with Roe Max.
Trout Spotted																		
Trout Other C. regalis	10	1½	82	23								93	24½					
Whiting			25	29	3	12	2	11½				28	41	2	11½			
Croaker			160	47½	9	21						160	47½	9	21			
Spot			30	16½	1	3						30	16½	1	3			
S. Fluke																		
N. Fluke			1	1¼								1	1¼					

NON-COMMERCIAL FISH

Species	No.	Size Min.	Size Max.	Size Dom.	Ounces
Anchovy	8	1¼	2¼	1¼	
Banded Croaker					
Cut fish					
Cutlass fish					
Rays D. americana	1	9¼	(Imm	♂)	
Sea Robin, Sl.	95	3½	4¼	4	
Star Drum	70	2¼	3	2¾	
Yellow tail					
C. striatus	4	4½	5¾	4¾	

Wt. trash fish =

8 lbs., 8 oz.

Species	No.	Size Min.	Size Max.	Size Dom.	Ounces
Chilomycterus schaepfi	3	1¹/8	2	1½	
Opisthonema o. oglinum	1	4¾			
Sphoeroides maculatus	1	2½			
Stephanolepis hispidus	1	3¹/8			
Orthopristis chrysopterus	12	4¹/8	5	4½	
O. Fluke	1	5			
Hog choker					
P. evolans	7	2½	3½	2¾	
Tongue fish	12	5	5½	5¼	
Whiffs					

Furloan—14784—7-64.

BEARS BLUFF LABORATORIES—WADMALAW ISLAND, S. C

I have no comment to make in connection with the report, Mr. Moderator, and if you would accept it as it is printed, I would appreciate it.

MR. STEIN: We would be happy to do that. This will be accepted without objection to be entered.

COMMENTS ON THE POLLUTION OF SOUTH CAROLINA
MARINE WATERS IN THE SAVANNAH RIVER BASIN AREA

By: G. Robert Lunz, Director South Carolina Wildlife Resources Department, Bears Bluff Laboratories and Division of Commercial Fisheries.

Potential value of Polluted Oyster Grounds.

The oyster grounds in the Wright River, New River, Ramshorn Creek, and in the vicinity of Turtle Island and Daufuskie Island, have long been closed to commercial oystering because of pollution allegedly emanating from the Savannah River. There are no records at Bears Bluff Laboratories or at the Division of Commercial Fisheries to show just when this area was first closed to oystering by the South Carolina Board of Health. Doubtless the State Board of Health will testify as to this date. From memory commercial oystering was prohibited in Wright River, New River and Ramshorn Creek at least as early as 1948.

"An Investigation of the Coast Waters of South Carolina with Reference to Oyster Culture" by John D. Battle, published in the Bulletin of the U. S. Fish Commission, Volume 10, for 1890, reports on a study made on parts of the South Carolina portion of the Savannah River Basin. The report comments on the great amount of mud in suspension in the waters of the Wright River and New River received from the Savannah River.

Despite this, the report notes the findings of large deep shell oysters in good condition growing subtidally in the area, and also notes that oyster boats were tonging similar oysters in deep water there. Hearsay evidence indicates that in the late 1800s a large oyster plant was situated on Daufuskie Island which employed more than 100 persons. Some of these oysters used in this plant came from the Wright River and Ramshorn Creek.

A brief survey of the area made in August 1959 by a staff member of Bears Bluff Laboratories, showed that the intertidal oysters were in rather poor condition, with a high mortality rate, and quite sparse. No evidence of cultivation or shell planting was observed, and the estimate was that the entire population including all sizes was probably less than 8,000 bushels of oysters in this area at that time. Subsequently, the Division of Commercial Fisheries encouraged the movement of oysters from polluted areas for relaying, and fairly large quantities of hitherto wasted oysters were removed from the Santee River. None was knowingly removed from the Wright River, New River, or any of the polluted areas adjacent to the Savannah River. The success, from the oystermen's point of view, of the Santee River movement encouraged leasing of the South Carolina portion of the Savannah River Basin. Sixty-three and six tenth acres of oyster lands were leased in this area. However, in 1962, the South Carolina State Board of Health found it was unable to properly supervise the relaying of oysters, and the practice was discontinued in the State. The oyster lease in the New and Wright Rivers was abandoned.

Because over the years the area was not properly cultivated by oystermen due to pollution, the productivity has been reduced. Based on the average production of other leased beds in unpolluted areas in the State of South Carolina, the 63.3 acre lease would ordinarily have produced between 6,000 and 8,000 South Carolina bushels annually. The South Carolina bushel is 89.3 per cent larger than a U. S. standard bushel measure. The present price of seed oysters is not known, but seed oysters such as could normally have been produced in the New and Wright Rivers two years ago, were worth about 68 cents a South Carolina bushel f.o.b. the oyster beds. Thus, the seed oysters which could have been grown and marketed from the area if it were unpolluted would have been worth between $4,000 and $5,000 annually to the lease holder.

No information is presently available as to the quantity or quality of the subtidal oysters in the Wright and New Rivers. The class of oysters would of course be much more valuable. South Carolina leases do not include subtidal oysters. Leases extend only to 1 foot below low water mark.

If the Wright and New Rivers could be declared suitable waters for the cultivation of oysters, the State could again lease the 60-odd acres. With proper management and planting practices this acreage would certainly be increased. The return to the oyster industry, and to the State in the form of direct rentals and taxes, would be significant.

If these oyster grounds had not been polluted and had been continuously open since their closure in 1948 (assuming no change in price structure) South Carolina oystermen would have harvested $64,000 to $90,000 worth of oysters.

Pollution Extended and Value:

Dye studies in the South Carolina portion of the Savannah River Basin indicate the possibility of pollution spreading beyond the closed area into the Cooper River and Calibogue Sound. ("Report on Pollution of Interstate Waters of the Mouth of the Savannah River, Georgia - South Carolina" by the U. S. Department of Health, Education, and Welfare, Public Health Service, dated November 1964.) If this were to happen, over 400 acres of oyster grounds, comprising parts of seven oyster leases presumably would be closed. As small as this 400 acres is, this would represent about 6 percent of all the total leased acreage in the State of South Carolina. Based on general knowledge of this State's oyster production a conservative estimate of the volume of oysters which could be taken from this area would be in the vicinity of 50,000 bushels annually.

The ex-vessel price of these oysters, because of their generally good quality, would be $1.00 per bushel. Thus, the spread of pollution into the Cooper River and Calibogue Sound would probably curtail the monetary return to oystermen leasing the areas by $50,000. In ordinary broad calculations of fisheries value, ex-vessel price can be multiplied by 3 to give the wholesale value of a fishery resource. Thus the present closed areas, plus additional areas if pollution follows the dye test indications, would cost the lower part of coastal South Carolina some $180,000 annually. These estimates of value are confirmed by Fisheries Statistics of the United States, 1962, Statistical Digest No. 56, U. S. Department of the Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, which gives the ex-vessel price of South Carolina oysters as being $1,168,000 for all oysters produced in the State. In this State practically all oysters are produced on bottoms leased from the State. There are 7,000 acres under lease. Thus each acre nets an annual ex-vessel return of $167. The 460 odd acres in the Savannah River Basin on the South Carolina side which are already polluted or are threatened with pollution then produce about $76,820 annually, ex-vessel price or $220,000 wholesale value. This value is not greatly different from the more conservative figure given above and obtained by different calculations.

In the Fisheries Resources of the United States, Senate Document No. 51, 77th Congress, published in 1954, in arriving at the total capitalization value of fisheries resources the author takes the value of the fisheries and calculates how much money invested at 4 percent per annum would be required to yield this value. Following that formula, the presently polluted area has an investment value to the State of South Carolina of between $450,000 to $600,000. If the pollution spreads, as indicated by dye studies, the investment value would approach $5,000,000.

Shad Fishery in the Savannah River:

The Public Health Service report mentioned above, dated November 1964 notes on page 12 that the Savannah River no longer supports a shad fishery. This seems to be an error. Although the Division of Commercial Fisheries does not have landing statistics for the shad from the South Carolina side of the Savannah River, licenses were issued for 64 gill nets to be used in the Savannah River during the shad season of 1964. No doubt, with accurate information available, the shad fishery in the Savannah River Basin would show a decline during the past 60 or more years, but the State of South Carolina does not have information which would support the statement made by the Public Health Service on page 12 of its report that the Savannah River no longer supports a shad fishery.

Information for Further Study Available:

Since 1953, Bears Bluff Laboratories has been keeping a continuous inventory of the fishes, crabs and shrimps throughout the greater part of South Carolina by monthly (and often more frequent) experimental tows with an otter trawl. Additionally, but by the same methods, rather extensive work was done in the Calibogue Sound in 1957 and 1958. In the regular state wide survey, two of the stations were in the areas which can be included in the Savannah River Basin. One of these, designated as "Bloody Point," is located between the mouth of Calibogue Sound and Tybee Roads, a few miles offshore of Daufuskie and Turtle Islands. The other is located in the upper end of Calibogue near a marsh island across from Bram Point. At these two stations, since 1953, considerable data has been accumulated. Specimen data sheets with the type of information on file at Bears Bluff Laboratories are attached in the Appendix.

Unfortunately, the Laboratories has neither the personnel nor the appropriations to make a special study of this long-time inventory. If this were possible, and these data were compared with similar information available for unpolluted areas with comparable hydrographic conditions in the State of South Carolina, more definite information might be obtained on the effect of pollution from the Savannah River on South Carolina fisheries.

(Continued on next page.)

MR. STEIN: Mr. Pringle, to reproduce this map, we will if it doesn't break us. I don't know that we are going to be able to have an insert made. I think we will make an appropriate reference to your red marks there as possibly a crosshatch because I think your references to the map and to the arrows need visual explanations.

MR. PRINGLE: I think, Mr. Moderator, that I can furnish you with a single page plate of that particular area. You won't have to reproduce or reduce it down. We can give you a sufficient copy that you could use.

MR. STEIN: We would be delighted to have that. That would certainly facilitate that and you can be sure that this will apear in the record if that is done.

I have just one comment here, but you talk about a dollar a bushel for one of those big old South Carolina bushels and talking about the value of the oysters, all I know, Bill, is when you come to Washington with me and we have a half a dozen on the halfshell, the current price is a buck and a half.

Now, someone is making a lot of money on these oysters, but I think when we talk about the commercial value of oysters, there must be some money there somewhere.

MR. LINTON: What worries us is that we are not getting it.

I would like to introduce Mr. Russell Gresham who is a member of the South Carolina Pollution Control Authority here who I saw here earlier. Mr. Gresham.

There are other distinguished people from South Carolina whom I will call on later if you want to and if you want to know who they are, otherwise, unless there are other South Carolinians who want to make a statement -- I started to say "a mistake" -- then that completes our presentation.

MR. FRASER: Mr. Chairman, I would like to make a statement on behalf --

MR. STEIN: Just one moment, sir.

I must indicate to you the rules here that I have done at the beginning. This is a conference between the State representatives and between -- and the Federal Government.

If you are a resident or a representative from South Carolina or Georgia, those agencies will have to call on you for your participation. But the way our law is written, and the way we work in question of harmony and States Rights, I think the rules are such that we only invited Federal participation and the state agencies, and they invite everyone within the states.

Now, you may want to consult one of your state representatives.

MR. FRASER: I represent the Beaufort County Board of Directors, which is the county immediately affected.

MR. LINTON: If he is asking me for permission to make a statement, Somers, what is your views?

MR. PRINGLE: I think Mr. Fraser might probably have something to add to the meeting.

MR. LINTON: We would like to have Mr. Fraser speak.

MR. FRASER: My name is Charles Fraser. I represent the Beaufort County Board of Directors which is the County of South Carolina immediately affected by the pollution of the Savannah River.

In connection with the discussion of the oyster industry we have made a series of studies in Beaufort County of the effect of the oyster industry upon the general economic wellbeing of the County and in each of the studies which we have had and several of which Mr. Pringle has provided information to our Board of Directors, and to our County Development Board, the significance of the oyster industry to the total economy of the County is extremely important.

We have a very high percentage of rural population who earned their total economic livelihood with the women shucking the oyster and the men gathering the oyster.

On Hilton Head Island, which is the island closest to the pollution from a standpoint of present oyster operations, we maintain normally four oyster factories operating full-time. These employ approximately 250 people, and represent a mainstay of the economy of that area.

Similarly in the Blufton area the oysters represent the primary source of livelihood of a significant portion of the total population. The same is true in the Beaufort area which North naturally is not endangered by any of the present pollution but in the lower half of Beaufort County the oyster industry does represent a major part of the total economy and the present pollution if continued, would seriously jeopardize the economic welfare of this oyster segment of our county economy.

MR. STEIN: Thank you very much.

Are there any comments or questions?

(No response.)

MR. STEIN: If not, I would like to make one comment. I think this was the point I was trying to allude to when I spoke to Mr. Linton, and you brought out too well, and that is the question of value of any crop like an oyster crop.

If you look at this realistically, it has to be related to all of the factors such as was just mentioned here in the last statement and further on into the marketing and other factors, these are all values of the crop.

When I was a boy, and I grew up on the sea coast area, too. I think we have an affinity of accent though I come from farther north. We used to get a dozen oysters for a quarter. Now, it is a dollar and a half for half a dozen. So, there must be some value there. This appalls me, and I think the reason for this, in talking to our compatriots in the shellfishing business and the people who work on the programs, is this question of supply and demand.

They say so many areas are closed now to the oysters that oysters are being pushed up and up until in a sense they might be almost pricing themselves out of the market, and there is an East Coast man who, I might say, that in my opinion, there is nothing like the Atlantic oyster.

MR. LINTON: You mean the South Carolinian oyster.

MR. STEIN: And I think most people who have not, are not really realizing that, that the Pacific oyster from most parts doesn't compare with it.

I am sure if there were any people here from the Northwest, they like those itty-bitty Olympias -- that is all right for them, but I think what we have here and have had here is a unique national resource, and I don't know that you can really determine the value of that unless we had one of these so-called in depth economic studies where the fellow checks input and output and they traced the product all of the way through.

So, I would suggest that we possibly have just scratched the value of these oysters in the statements that I have heard here in their value to the economy.

MR. FRAZER: Mr. Chairman, a further word on that. There has been considerable study done by the County, Beaufort County, through privately financed research on the development of alternative methods of producing oysters to reduce the cost of the bushel of oysters on the dock at the packing plant. Various types of suspensions of pen cultures such as done in Australia and on the Pacific Coast. There is always a great many experiments going on along the coast in methods of increasing the efficiency of the shucking.

Dr. Pringle has done much work on that also, and should any of these technical studies prove successful, it would result in a breakthrough in the economics of the oyster industry making the present cost structure such that we could compete more effectively with certain other areas.

So, the present production, which I gather from subtracting the figures, would be Beaufort County producing approximately one and one-half million pounds of oysters per year, could be very substantially increased if any of these research projects proved successful.

Thank you.

MR. ROGERS: I had one comment here in connection with Dr. Lunz' statement, the statistics only apply as to the leased oyster beds.

MR. LINTON: That is the only thing he has to do with and that is leased oyster beds.

MR. ROGERS: I wonder if there is any value on areas that have not been leased to the State.

MR. LINTON: They had better not take any oysters from areas not leased by the State.

MR. STEIN: As I said, I grew up around oysters.

(Whereupon, there was discussion off the record.)

MR. LINTON: The situation here is, I think, the taking of shellfish under patrol procedures from condemned areas is more difficult than it has been in the past. I would say further that the elimination of this practice would result in all of us being commissioned peace officers and getting out in the river and you know this is not a practical application, but I say this, as far as the economics of the oyster situation is concerned, you said you had to put everything into balance, let's consider for a few minutes the socio-economic status of the people who are involved in the oyster gathering.

For instance, if this mechanism were not available to that particular strata of the culture of this particular area, they would be wards of the individual states. So, this is an economic consideration, and I say again that as far as any contribution is concerned, in connection with matters of this kind, we want to put all of the factors in the balance when we make determinations that this particular procedure is designed to make.

(Whereupon, there was discussion off the record.)

MR. STEIN: Are there any further comments or questions?

MR. LINTON: Not from me. That is all from South Carolina that I know of.

MR. STEIN: May we now call on the State of Georgia, Mr. Howard.

MR. HOWARD: Mr. Chairman, conferees, ladies and gentlemen, I am R. S. Howard, Junior, Executive Secretary to Water Quality Control Board and represent the Georgia Department of Public Health.

I would like to, if the Chairman would permit me, at this time to introduce the four members of the Georgia Water Quality Control Board who are here today and are interested in this matter of pollution.

First, Mr. Ted Fob, Mr. Lyle Becham and Mr. Bailey and Mr. H. E. Edisen, Please stand up and be recognized. (applause).

MR. HOWARD: Georgia has received and studied the report, "Pollution of Interstate Waters of the Mouth of the Savannah River, Georgia-South Carolina" made by the Public Health Service of the U. S. Department of Healtn, Education and Welfare. We accept the findings of this report that the Savannah River estuary is grossly polluted bacteriologically, chemically and physically from discharges of untreated or inadequately treated sewage and industrial wastes. In fact, State and local concern for the pollution of Savannah Harbor predates any surveys or studies presented in this report.

Georgia agrees that this pollution is of an interstate character and that it may have adverse effects on the health and welfare of our neighbors and good friends in South Carolina. Such effects are not demonstrated in any tangible way by this report, but it seems clear that these adverse effects are of a more serious nature in the intrastate waters of the Savannah estuary. We understand this pollution is detrimental to industrial water supplies, water sports, shellfishing, boatmen, fish and wildlife, even though the report does not show the extent of such damage.

Georgia recognizes its responsibility to work cooperatively, in accordance with State laws, with the municipalities and industries involved to abate this pollution. We intend to move towards this end with understanding, perserverance and urgency. The problem is one of a wide and complex character, the social and economic aspects of which are not considered comprehensively in the report. The extent of the danger and damage to the health and welfare of Georgia and South Carolina residents has not been defined in any material way. These matters and the solution of the overall pollution problem demand additional, detailed studies to determine what should be done and how we can best do it.

With South Carolina's agreement, we would suggest formation of a technical advisory committee to conduct further studies for developing a practical plan for abatement. Committee members would represent South Carolina, Georgia and the U. S. Department of Health, Education and Welfare. This committee would conduct such studies and surveys needed to produce a workable plan for abatement of the pollution in the Savannah

River estuary.

Mr. Chairman, we think the report is a very fine one. Inclusion of plankton measurements and biological observations on aquatic organisms other than bacteria would have been useful, especially in reference to pollution of interstate waters at the river's mouth. Also, we feel there should have been some reference to the economic and social factors of the problem. However, we congratulate those who prepared the report and those who participated in the surveys. We believe it is a contribution to stream pollution control.

And that is the end of my statement at the time, Mr. Chairman.

MR. STEIN: Are there any comments or questions?

(No response.)

MR. HOWARD: First, I would like to ask if Mr. Mendonsa is here from Savannah, the city of Savannah.

He is prepared to make a statement and I would like to recognize him at this time. He is the City Manager of Savannah

MR. MENDONSA: Mr. Chairman, we would like to make a brief statement describing what Savannah has done, what it is doing and what it proposes to do with reference to this problem.

Until 1952, all the sewage from Savannah's sewage system was dumped, untreated, into the Savannah River. That year, the City constructed its first sewage treatment plant and began to collect and treat the sewage from the newly developing areas of the City. Since then, the City has constructed three oxidation ponds to serve these areas.

Over the past twelve years, the City has spent more than $5 million on treatment facilities. During this period, there has been no increase in the volume of sewage entering the Savannah River from the City's sewage system.

The City of Savannah recognizes the need to collect and treat the sewage which the City's sewage system is now dumping, untreated, into the Savannah River. To this end, the City has employed an engineering firm to study the problem, and propose a program through which the untreated sewage can be collected and treated. The final report on this study is expected shortly. However, a preliminary report of the study indicates that it will cost more than $11 million to collect and treat the untreated sewage.

It will be necessary for the City to schedule the projects needed to correct this problem over a period of years. A list of the projects needed to accomplish this task is attached. The cost estimate for each project is also shown on this list.

The Mayor and Aldermen have directed that plans and specifications be prepared on Projects 1 through 5. Engineers are being selected to do this work. We propose to finance these five projects through a water and sewer revenue bond issue. We expect construction to begin in 1966. Work will be scheduled on the remaining projects as funds become available.

We are aware of the problem which exists. We recognize that something must be done to correct this problem. We are taking steps to do this. But we need help. We hope that you will use your considerable influence to stimulate research in the field of sewage treatment, to find more efficient and cheaper ways of treating sewage. We also hope that Congress will liberalize programs of Federal grants for construction of treatment facilities.

Thank you very much.

(Continued on the next page.)

SAVANNAH, GEORGIA February 2, 1965

List of projects which will be required to separate sewage flows from storm sewers; and to collect and treat the untreated sewage that is now being dumped into the Savannah River and other streams and canals by the City sewage system.

1.	Oglethorpe Avenue Interceptor Will remove sewage from S&O Canal	$578,000
2.	River Street Interceptor	121,000
3.	Laurel Grove Interceptor Will remove from Springfield Canal and treat at Cloverdale	32,000
4.	Victory Drive - Hopkins Street separation Will remove sewage from Springfield Canal	236,000
5.	Systems discharging to streams other than the Savannah River	454,000
6.	Sewage treatment plant	5,115,000
7.	Divert dry weather flow from Bilbo Canal and Kayton Canal	70,800
8.	Industry Drive Interceptor	1,052,000
9.	Paulsen Street Interceptor	1,234,000
10.	Kayton Canal Interceptor	2,305,000
	TOTAL	$11,197,800

MR. MENDONSA: Thank you very much.

MR. STEIN: Any comments or questions?

MR. ROGERS: On your list for the first five projects, do you have a time when you would like to get these?

MR. MENDONSA: The first five projects which you are referring to, which we say we are selecting the engineers now to prepare the plans and specifications, we hope to put these into construction in 1966.

MR. ROGERS: Is there any target date for finishing these?

MR. MENDONSA: Well, we will let the contracts for these five projects and the work will proceed as rapidly as the contractor can complete it. I would assume that from the date the contract is let that would probably be up to the area.

MR. ROGERS: Of course, of the first five projects, how much of the problem does this actually take care of?

MR. MENDONSA: The first five projects are primarily projects which will -- As you know, in the older sections of the City, we have storm sewers and sanitary sewers combined. These projects will be designed primarily to separate these systems, the storm sewers, from the sanitary sewers and to relieve or remove storm water which is now entering one of our treatment facilities, and one of our oxidation plants.

MR. ROGERS: Can you tell us anything about a schedule on the remaining projects?

MR. MENDONSA: As I stated in my statement, we will proceed on these projects just as rapidly as our funds will permit, and I cannot tell you any more than this.

MR. STEIN: How much of the $11 million is the first five projects?

MR. MENDONSA: A million and a half dollars.

MR. STEIN: The only problem you have on the rest of it in terms of time schedule, I am talking about, is the availability of financing, is that correct?

MR. MENDONSA: That is a considerable problem, yes, sir.

MR. STEIN: We recognize that, and I think the key point here that you have was the indication of when these projects would be completed, I think the key statement of any of these things is always the financing, particularly with a municipal project because once financing is arranged it behooves everyone, particularly the City, to get the project under completion as rapidly as possible so they are not just paying interest on the working on the construction.

If you have revenue bonds, the revenue can begin coming in when you are completed, and how do you intend to finance these projects in 1966, these first five?

MR. MENDONSA: These first five will be from revenue bond issue.

MR. STEIN: Has the authorization for that already been achieved? Do you need a vote of the people, a vote of the City Council? How is that done?

MR. MENDONSA: A vote of the City Council.

MR. STEIN: Has that been done?

MR. MENDONSA: No formal action as yet has been taken but the Council has indicated that it will proceed.

MR. STEIN: Thank you.

Any further questions?

(No response.)

MR. STEIN: May I just ask one further question. This may be directed to everyone here. As I understand, the completed project for municipalities, as I understand the Georgia program, will contemplate secondary treatments, is that correct?

MR. HOWARD: Jack?

MR. FRANK: Right.

MR. ROGERS: One other point here, Mr. Howard, you mentioned this technical committee.

Do you anticipate any other studies needed for the City of Savannah that the engineering is going ahead?

MR. HOWARD: No, not specifically for Savannah, but the overall problem, I think we need additional studies on. We have to determine such things, for example, the extent of the treatment which might even go beyond secondary treatment.

MR. STEIN: Are there any further comments or questions?

(No response.)

MR. STEIN: If not, thank you very much.

MR. HOWARD: Now, Mr. Chairman, I would like to recognize at this time Mr. James R. Lientz, Vice President of Union Bag-Camp Paper Corporation who would like to make a statement at this time.

MR. LIENTZ: Mr. Chairman, my name is James R. Lientz and I am Vice President of Union Bag-Camp Paper Corporation.

The Savannah plant of Union Bag-Camp Paper Corporation, which produces pulp, paper, linerboard, bags, corrugated shipping containers and chemicals, is the largest operation of its kind in the world.

The plant began operations in 1936. Its daily rated productive capacity at that time was 120 tons of paper. The plant employed approximately 500 persons, whose total annual wages approximated $1,000,000.

Today the plant produces 2,500 tons of paper and paperboard daily, and employs 5,000 persons, whose annual wages total $33,800,000.

Other economic contributions made by the plant to Savannah and the area in 1964, included pulpwood purchases of over $18,000,000, and freight payments totaling over $17,000,000. Inbound and outbound freight cars total 90,000 annually, representing 40 percent of all rail cars handled in the metropolitan

Savannah area.

Union Bag-Camp Paper Corporation's 1964 payroll to residents of South Carolina, which includes the employees of the company's Spartanburg box plant supplied with paperboard from Savannah, totaled $1,100,000, and the company purchased pulpwood in 1964 in the amount of $2,700,000 from South Carolina tree growers.

Occupying the position we do in the Savannah community, we are deeply concerned with any conditions in the Savannah Harbor, which might adversely affect the health and economic welfare of anyone in this area. The Savannah Harbor must continue to be recognized and maintained as a major contributor to the economy of the Savannah area and the State of Georgia, and hopefully with a minimum of adverse effect on other legitimate uses of the river.

We recognize that conditions do exist in the Savannah Harbor which pose a problem. The U. S. Public Health Service report mentions both bacterial pollution and pollution caused by lowering the oxygen content of the water. The former is the only pollution which can be considered dangerous to health. At the same time we agree that Union Bag-Camp Paper Corporation does contribute to the lowering of the oxygen content of the river water. We, however, would like to clarify any misunderstanding which might prevail among our citizens on the part our plant and other industrial installations play in the total problem.

The Union-Camp wastes which affect water quality in the Savannah Harbor area are those which use up oxygen in the water. The oxygen using materials in paper mill wastes are soluble materials from wood, principally derivatives of wood sugars. They are not poisonous. They do not constitute a health hazard. In proper quantities they contribute food to the small organisms which provide food for fish. They do not adversely affect the South Carolina or Georgia oyster beds. The only adverse effect they have is to lower the dissolved oxygen content in the main ship channel, and in short stretches of some side channels, below those levels which are recommended for good aquatic life.

As has been indicated we are concerned generally as responsible citizens with all aspects of the Savannah Harbor pollution, especially that which may affect public health. Since our operations, however, affect only the oxygen content of the water, this statement will concentrate on this particular phase of the overall problem.

We have used the Savannah Harbor for the disposal of certain waste materials since 1936, in accordance with normal use of a stream in an area that has been regarded and used as a commercial and industrial waterway. As times and requirements have changed and as more efficient equipment has become available to us we have made less and less use of the river for the disposal of wastes.

We no longer discharge certain coarse rejected fiber into the river because these materials might potentially foul ships' condensers or form sludge banks. We have installed screens to remove a substantial percentage of bark particles, and are now improving this equipment as a means of retaining additional amounts of finer bark material. We took a leading part in the campaign sponsored by the Savannah District Authority to free the harbor of old timbers and other debris which constituted a menace to ships' propellers. We have cooperated with the United States Coast Guard which is charged with the enforcement of the laws prohibiting the discharge of floating oils into the harbor, by installing a flotation basin and skimmer to remove oily waste from the discharge. Foam from our plant which created unattractive trails on the river surface has been practically eliminated through the construction of preventive installations.

Union Bag-Camp Paper Corporation has not evaded its responsibilities as a corporate citizen of the Savannah community and the State of Georgia. Our expansion programs for the past ten years, involving cash expenditures over $50,000,000, have taken into consideration a greater control of oxygen using effluents from our plant. When we make a ton of product today we put in the Savannah Harbor nearly 40 percent less oxygen demanding wastes than a ton of product would have caused in the middle fifties. While we have substantially increased our production, with resultant additional contributions to the economy of this area, we have not increased the oxygen demanding material discharged to the river. Our current program of expansion, which includes new waste controlling equipment, will be carried out with no increase in waste discharges and may effect some decrease.

The alleviation of conditions in the Savannah River requires, in our judgement, careful and intelligent planning and programming. We must balance the necessity of keeping our industries economically healthy and our harbor competitive against the desirability of ideal rural water conditions. The establishment of goals should be realistic. They should take into consideration the future of the Harbor of Savannah as a port of entry for the largest of ships.

The report of the U. S. Public Health Service contains much valuable information. The report does form a basis for further study. We believe this study should take into consideration all of the factors that adversely affect the oxygen content, and also the ability of the harbor area to support a flourishing aquatic life under any oxygen conditions as long as the navigation channels are maintained.

For example, the water coming into the Savannah Harbor contains a substantial quantity of natural oxygen consuming material , apparently from the river swamps. This is highly variable and, at times, very substantial. This suggests the need for a more thorough analysis of all of the facets of the oxygen demand problem.

The U. S. Public Health Service report implies that a 4.0 parts per million dissolved oxygen content would be desirable or shoud be maintained. The fact that we have measured dissolved oxygen in the main channel of the Savannah River as low as 3.7 parts per million at a time when both paper mills at Savannah had been shut down for several days suggests that the Public Health Service report's figure might well be both impractical and unattainable. A goal of 4.0 parts per million might be incompatible with any practical use of a major asset of the harbor -- it's ability to assimulate waste.

Another factor which we think should be more fully explored is the effect that silt and channel maintenance have on the Savannah Harbor and River. The U. S. Public Health Service report refers to estuaries as "the nurseries of many important fish and shellfish." There no doubt are natural estuaries to which this description would apply. This would not be the case insofar as the Savannah Harbor is concerned.

The maintenance of deep navigation channels has changed the nature of the Savannah Harbor to such an extent that it probably never again will support a vigorous aquatic life. Instead of a stable, natural bottom, of some 16 feet deep and 200 to 550 feet wide, an average of 7,000,000 cubic yards of natural shoal material falls to the bottom of the inner harbor each year. This results in the smothering of bottom organisms, which support aquatic life, by silt which is periodically removed through the process of dredging. Under these conditions there can be little of the bottom life which must be present to provide food for fish life and growth.

A more detailed study of the potential of the Savannah River harbor for fish propagation would seem to us to be reasonable. There is no assurance that, even if all oxygen demanding effluents were removed from the harbor area, any reasonable amount of fish growth would result. It might well be improvident for us and other industries to invest large sums of money in waste treatment equipment if no appreciable benefits would result for the two-state area as a whole.

We have provided the staff of the Georgia Water Quality Control Board with technical data compiled as a result of the studies and surveys which we have made of the Savannah River. Additional material is available to this regulatory Board. We have confidence in the competence and judgement of the Board and it is our desire and intent to work with the Georgia board to determine what goals are realistic for improving the water quality of the Savannah River.

(Continued on next page.)

MR. STEIN: Thank you very much, Mr. Leintz.

Are there any comments or questions?

MR. HOWARD: No.

MR. ROGERS: Could I ask a question?

You have been stressing the fact here that there is no effect on the health of the people and -- but doesn't the fact that the industrial waste reduces the desirable oxygen limit the development in the area as far as other organic type of industries?

MR. LEINTZ: Mr. Rogers, I don't think that I am qualified to answer that question. It has not limited the development of ours.

MR. ROGERS: Well, the fact though that the entire oxygen of the river is being utilized, I think this is evidence that other industries could not move in.

MR. LEINTZ: Again, I don't think I am qualified to discuss that particular question.

MR. STEIN: Mr. Leintz, I have a couple of comments here. I think the point should be made, and this is made over and over again, and I have made it many, many times that pulp waste, paper waste by themselves are injurious to health as they are discharged into a stream; but the point is, if you, as you pointed out in your rather large payrolls and the number of people working there, you need people around, and people discharge domestic waste into the stream, I don't know that that stream is an avenue for absorption of that, if the oxygen is removed, and I don't know if you want to comment on that, but there really is, I assume, a relationship between lack of oxygen in the stream, particularly when you are near a municipal area where pathogenic organisms are put in, generally speaking, a stream with more oxygen in it can handle those wasts better than the stream with less.

Now, there is one other curious statement that I have been reading. I'm kind of a student of pulp and paper industrial treatments and really very good, getting better all of the time.

They are -- I read here -- you talk about your waste. You say in proper quantities they contribute food to the small organisms which require or are required for food for fish. I guess they will make it good for fish. I don't know if this happens in the laboratory, but really I don't know of any plant operating that the contention has been made that this is good, really good for the fish.

MR. LEINTZ: Well, Mr. Stein, I have to fall back on our technical staff as a source for that information, and I will put it this way: We are not in the market of recovering waste to feed fish and I am sure it is not a very big factor, but that is a possibility that exists chemically, I understand.

MR. STEIN: But in the field, as far as I understand it, no one, the Fish and Wildlife Service and the State Fish and

Wildlife Services, as far as I know, have ever selected a place downstream from a pulp and paper mill to really start and really build fish, and as far as I have been able to understand, and really, I have not singled that out as the ideal situation.

MR. HOWARD: Are you saying they are toxic?

MR. STEIN: I didn't say they were toxic to shellfish. I was talking about the statement here that they are good for fish.

MR. HOWARD: But you can't prove that they are not good.

MR. STEIN: I wasn't saying that.

MR. HOWARD: In controlled amounts.

MR. STEIN: When there is no oxygen, I think it is harmful for fish.

MR. ROGERS: Let's assume that it is good for fish, if you haven't got the oxygen, how is the fish going to live? I think that is the real question.

MR. LEINTZ: The statement was merely put in this report to emphasize the facts that we are talking about a material that is certainly not harmful, nonpoisonous. It wasn't, and it does not imply the absence would not create an improvement from the viewpoint you are expressing.

MR. STEIN: I notice, frankly, I think the issue here, and this is a question of pulp and paper waste being poison, the damage from pulp and paper wastes that I have examined throughout the country is not a question of poison, it is a question of importance, and that question is a question of oxygen in the water admittedly interferes with the fish life.

Now, in your report you talk about 4.0 parts per million dissolved oxygen, and so forth. I think Mr. West in his report talks of stretches in this river which were consistently below 1.0.

MR. LEINTZ: We didn't debate the difference.

MR. STEIN: I think this is the issue. Now, I have just one further comment on this and we would like to get areas of agreement. This is, I guess, why we are here, and your report on page 4 and accordingly, "The alleviation of conditions in the Savannah River --" and I will skip a few sentences. "The establishment of goals should be realistic. They should take into consideration the future of the Harbor of Savannah -- and so forth.

Then you go on to say, "The report of the Public Health Service contains much valuable information. The report does form a basis for further study."

This is taken from your report.

Now, when we compare it to the State of Georgia's report, we may find a substantial area of agreement, they say, with South Carolina's agreement, "We would suggest formation of a technical advisory committee to conduct further studies for developing a plan for abatement. We congratulate those who prepared the report and those who participated in the survey. We believe it is a contribution to stream pollution control."

I am quoting all of this from -- not in order -- but from one page of the Georgia report.

So, I see a real substantial area of agreement between your presentation and the State of Georgia.

MR. LEINTZ: Well, there is no intention not to have a substantial area of agreement.

MR. STEIN: I say that we are looking for and very interested in areas of agreement. That is what we are trying to do.

MR. LEINTZ: I understand. This is one we do agree with the State authorities on.

MR. ROGERS: We realize in doing our short survey we may not have been in there during the critical times, and we did not find actually in any of our studies that the oxygen was down to zero but I understood there have been such conditions.

Would your studies indicate this?

MR. LEINTZ: I can't quote any detailed figures because I don't think these are the kind of things to keep in mind. I will give you credit for getting about the most critical time of the year as you possibly could.

MR. ROGERS: Excepting a time of unusual rainfall and particularly in the local areas.

MR. STEIN: Mr. Leintz, I tell you that our people and our studies are designed to get at the most critical times. They always complain they get messed up because it is a little rain, and it is not that way, but I think in pollution control you are dealing with something that as you deal with any kind of a utility system, you take an electric utility system, at least a little farther up North, you have to have enough juice in the system so that it will work when the men turn their lights on in the office and the ladies are turning on the lights at home and they are starting in on cooking, on a winter afternoon this is the critical point.

I think in pollution control which generally happens at a dry period and generally during a summer period, if you are not able to hide the situation over there, then you may have a rather severe condition in the stream that will break down.

I don't think that either the state's agencies, either one of these states, or us, when we go out and survey, look for any critical conditions, any but critical conditions, as I would expect that you design your total plant and the component parts of your plant to handle peak loads of critical conditions. This is generally the way everyone, at least in this country, seems to be doing it.

MR. LEINTZ: I think that is a reasonable way to put it.

MR. HOWARD: I have no questions right now.

I have one more witness.

I would like to at this time recognize Dr. Wilbur Lindquist who is Director of Public Health in Chatham County. Would you please stand up and be recognized. (applause.)

I have one more witness, and I have known him a long time. He is, I guess you would say, he is a professor of sanitary science, or semi-retired and he told me he would like to make an objective statement.

My experience with him is that this usually last a long time, so I am warning him now to have a brief statement and let it be objective and I would like to introduce John M. Henderson, who is from Savannah.

MR. STEIN: By the way, we are going to try to make an effort to get these fellows on their 4:00 o'clock plane. All the time we take up now comes off the lunch hour, or whatever else you want to do.

Go ahead.

DR. HENDERSON: The Public Health Service Report is a good report which, together with two earlier ones, adds to the fund of information on Savannah River pollution. It helps to confirm the apparent need for pollution abatement.

The studies on which the report is based demonstrate the merits of model dye studies carried out in conjunction with sample collection and analysis -- one to show where the pollution comes from and where it goes, the other to show pollution concentration at various points.

One noteworthy feature of the report was the dye study finding that 5 percent of the flow of the Savannah River enters the intrastate Wilmington River system.

Some of the study findings and report text indicate that the degree of pollution abatement which might be carried out and the benefits that might result from them should be based on what is practical and feasible, rather than on an attempt to meet arbitrary objectives.

As an illustration of this point, oysters were once harvested from downstream interstate reaches of the Savannah River but the practice is now banned due to contamination. In this connection it is noted that at Mile 28, well upstream from metropolitan Savannah, the median total coliform content of the river water amounting to 1100 MPN was 16 times greater than the shellfish standard of 70. The value of 1100 is by no means unusual for streams receiving land drainage from agricultural areas contributing coliforms of soil, farm animal and wild animal origin. In fact, an average total coliform value of as high as 35,000 MPN can be cited for the dry weather flow of a small stream serving a drainage shed containing no sewage discharge. The land drainage nature of the contamination at Mile 28 is demonstrated by the fact that the so-called fecal coliform content from warm-blooded animals was only 15 percent of the total coliform content.

In view of the nearby urban and suburban land drainage contribution which the river receives downstream from Mile 28, it seems evident that the total elimination of all downstream sanitary sewage from the river could not clear all river reaches for oyster harvesting. It further raises the question as to how far back in time it was when the median total coliform content was below the then nonexistent standard of 70.

In appraising this statement, the slower death rate of coliform bacteria which takes place in cold stream water during some months in the oyster harvesting season should not be overlooked. Coliform results in the pollution study were those of stream temperatures in August.

Thank you.

MR. STEIN: Are there any questions or comments?

(No response.)

MR. STEIN: If not, we will stay recessed until 2:00 o'clock and I should tell you we are going to start very promptly at 2:00.

This is where all the fun is because we come to the discussion and the conclusions.

Thank you.

(Whereupon, the luncheon recess was taken.)

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LARGE MAP OF OYSTER BOTTOMS IN VICINITY OF NEW AND WRIGHT RIVERS
LOCATED IN BEAUFORT COUNTY, STATE OF SOUTH CAROLINA

NOT PRINTED

Available in file copy of original transcript
U.S. Department of Health, Education, and Welfare
Washington, D.C.

AFTERNOON SESSION

2:00 o'clock p.m.

February 2, 1965

MR. STEIN: (Gavel) May we reconvene?

Now, before we get started with the discussion, I would like to again canvass the state agencies and the Federal representative to see if they have anything additional to add that we haven't covered this morning.

If not--

MR. LINTON: I would like to ask a question in connection with the statement as it applies to the bacteriological requirement for general recreational activities.

Apparently this is going to cause some controversy if it is lifted in context out of the report. I would assume that the general interpretation of this thing, general recreation would include swimming and the bacteriological limitations as defined in the report, 1,000 MPN as the recommended limit could easily be confused with the statement here that 5,000 per 100 million liters is applicable for general recreational purposes. I would just simply make this as a suggestion, that the report be very explicit in making this matter knowledgeable and in the future to keep this statement out of subsequent reports because it could be quite confusing.

MR. STEIN: Do you want to say anything about that, Mr. Rogers?

MR. ROGERS: Maybe I could better clarify.

MR. STEIN: As I understand this, Mr. Linton, is that generally speaking the bacteriological count for water contact sports, that is, swimming, boating where the spray is hitting you, fishing where your line and rod comes into contact with water and so forth and so on, the count there generally is higher or the permissible count is considerably more safe if it is higher than it would be for swimming, is that correct?

MR. LINTON: Yes.

MR. STEIN: I don't think there is any disagreement in this. I think this is quite logical. If you engage in sports where you can only be completely emersed in water and another sport where you just have casual contact with the water, obviously, the water where you are going to be emersed is going to have a higher quality.

MR. LINTON: The point that I make is simply this, that if for instance on top of page 3, you take in context -- out of context the statement "5,000 MPN per 100 million general recreation objective," that it is very likely that the lay mind would interpret this to mean that the general recreational objectives include swimming, so, what I am asking you to do to delineate this quite emphatically and in the future and in subsequent reports to eliminate this general recreational objective as a differential.

MR. ROGERS: Just use the objective of 1,000 swimming.

MR. LINTON: Yes, yes.

MR. STEIN: He is talking about the category, general recreational objectives. I think that that might possibly be phrased, and check me, Mr. West, if you will agree to this: This deals with water contact sports such as fishing, water skiing and boaters. Is that what that means?

MR. WEST: Yes. Now, I wish I would have stated 5,000 for boaters, fishing, picnics and 11,000 for swimming, water skiing and so forth.

MR. LINTON: Right. That is what I wanted to say.

MR. STEIN: This is wrong.

MR. LINTON: This is the only comment.

MR. STEIN: Are there any other comments or questions?

If not, perhaps we can -- Well, Mr. Rogers has a comment.

MR. ROGERS: There was a question that came up before the lunch hour as to the toxicity of some of the MRI and I think the literature is quite clear that there is some problem involved here on toxicity of these wastes and if you would like to elaborate on this or any questions by the Conferees, maybe we could call on Mr. Black to come up and discuss this point.

MR. LINTON: There is nothing in my mind.

MR. ROGERS: Any questions of the conferees?

MR. STEIN: Do you want any elaboration?

VOICES: No.

MR. STEIN: If not, I think we should just leave it at that.

Mr. Rogers has a point that this question of toxicity of pulp and paper waste should not be completely foreclosed.

Now, if we can get to the statutory requirement of the Summary and see how much agreement we can come to among the Conferees, all right.

I think first we can say that the lower 28 miles of the Savannah River and its estuaries, tributaries and connections comprise interstate matters within the meaning -- an interstate water system within the meaning of the Federal Water Pollution Control Act, and certainly the Savannah River meets the statutory definition of an interstate waterway as either flowing across or forming part of boundaries between two and more states, the states here being Georgia and South Carolina.

I think that there was substantial agreement among the Conferees that municipal and industrial waste sources in discharging waste into the Savannah River, its tributaries, its connecting waterways, or its estuaries were contributing to pollution of these waters.

The Georgia report,as a matter of fact, indicated that the estuary is grossly polluted bacteriologically, chemically and physically from discharges of untreated or inadequately treated sewage and industrial wastes. I think we, from the report, can agree that a significant portion of this pollution is interstate in character and subject to abatement under the Federal Water Pollution Control Act.

I think it is rather obvious from the reports of all concerned that the measures taken up to now have not been adequate to abate this pollution. I think that when we determined the nature of the lays, if any, we find ourselves dealing with a relatively complicated industrial and municipal problem and an estuary problem. The scientific knowledge which is needed to cope with these problems is just coming into the fore. This is a problem facing many, many areas of the country. I think we have to commend the parties concerned, certainly both the state agencies for an active program, the City of Savannah for lookinto this and developing plans, the industries for its concern with the problem, and that all parties concerned, I think, want to take whatever measures are necessary to abate any pollution that is shown.

I think that in particular we should place for commendation the programs of South Carolina and Georgia because without the work that these states' programs have accomplished, the report that you saw developed today would not have been possible. A good deal of data and cooperation came from the state, the state agencies.

I think again that the pollution in these areas has affected the industrial water supply, water sports, shellfishing, boatmen, fishlife, wildlife, sport fishing and hazards to those engaged in water contact sports.

It has also proved detrimental to fish runs and the oyster fishery.

Now, I think also that due commendation should be given to the program of the City of Savannah who began working on its program for pollution abatement from the city, the five projects that it has indicated will be started in 1966 and completed in 1967, certainly a step in the right direction and I think should be commended by the conferees.

I think also a determination of the -- or an indication of the complexity of the problem was indicated by the conferees and by people making statements before this group. I think the sense is, or the concensus is that a technical committee should be established of representatives of the States of Georgia and South Carolina and the Department of Health, Education, and Welfare who will evaluate the situation and come up with conclusions so that abatement procedures in this area may be facilitated, and that remedial works may come into being where necessary as soon as possible.

It is suggested that both states in conjunction with this technical committee work up a schedule for completion of treatment works by all of the municipalities discharging waste into the Savannah River, its connecting waters or estuaries within the next six months, that this construction schedule be set forth, be completed within the next six months, and reports of that be made available to all conferees including the Federal Conferee.

It is recommended that the industries in the area also be included in this activity of the state agencies in conjunction with this technical committee, that a schedule be completed by the end of six months where all industries will remove from -- the wastes being discharged into the state waters of the Savannah River, its tributaries, connecting waters and estuaries, substantially all settleable solids and fibers and that a commensurate program be set up for any other industrial waste that needs to be abated and removed, that if possible where determinations are made, a schedule for the removal of any such other industrial waste be submitted and developed at the end of the six month period, or by the six month period and sent to all of the Conferees, that if the technical committee agrees that further work has to be done in evaluating some of the industrial waste past the six months period, and this is, this is agreed to by all of the representatives of the technical committee that a schedule for these future studies and evaluations should be set up at least within the six months, that the study should be undertaken and that within the time of these studies is completed, a schedule, time schedule for such additional remedial facilities as are needed be promulgated by the state agencies and this be made available to all of the Conferees.

Now, the floor is open for comment.

Any suggestions?

MR. HOWARD: One thought occurs to me, we have, well, perhaps others in the state were involved, sections by the Savannah River estuaries and we also probably have other contributors -- I have reference to the inland waterway, for example, that affects the shellfish industry, and the shrimping and so forth around Wilmington Island and Wilmington River and I think that there ought to be noted here that Georgia is going to look into that business and see whether or not there are steps that we should take in that direction now.

MR. STEIN: Is that connected with this waterway, sir?

MR. HOWARD: It is related to this waterway. I don't know how that overlaps, but I think it is common knowledge in that area that we have that problem.

MR. STEIN: I should point this out,that in dealing in interstate water there is no point in cleaning up those waters if when they go into the state those waters are going to be made dirty again and I think that is an equitable thing and that is the receiving state has a responsibility to clean up those and this is something like the clean hands doctrine in equity, you can't ask someone upstream to clean up waters for you and as soon as it comes down to you for you to make them utterly filthy again, and I think we would thoroughly support the State of Georgia in that effort.

Are there any other further comments or questions?

MR. LINTON: I think this would be the thing to do.

MR. STEIN: Now, is there anyone in the room that wants to say anything?

Mr. Rogers pointed this out.

I think what we are talking about here specifically is the lower 28 miles of the Savannah River, its tributaries, estuaries, connecting waters and all of the other waters affected or having a relationship to it such as Wilmington Island area as Mr. Howard has outlined. That is what is covered by here. We wanted to be very careful about the area of jurisdiction.

If there is nothing more, I want to say that for me this has been a most productive conference. I think if this --

MR. LINTON: I want to ask one question, just for the record.

Would you put in evidence the responsible parties that brought about this meeting here today? Celebrezze called you?

MR. STEIN: Yes.

MR. LINTON: Who was responsible for his calling?

MR. STEIN: I will be glad to tell you what I know about that.

Secretary Celebrezze called us on his own initiative.

The Secretary has a program as every Secretary of a department has, of keeping all major interstate waters under continuous surveillance. We prepare routine summary reports and keep a docket on that, so to speak.

The Savannah River has long been one of these rivers. These reports are sent over to the Secretary on a regular basi and as a matter of fact, periodically all of them are selected. Obviously, as with any state agency or perhaps any industry or any city, there are just so many people and just so much money that the Secretary cannot call conferees on all rivers at once, and he makes a determination on the basis of reports, surveys and studies on the rivers he believes to have pollution subject to abatement in the Act that he judges in one state endangers the health, welfare of a person in another state.

He came to that conclusion on the Savannah and issued directions to us to prepare the necessary papers on that, signed the papers and sent them, but this was not done on request of a state agency or a municipality in a state. This was done on the initiative of the Federal Government.

We would like to think this is a cooperation and we are a service.

I would like to thank all of you for coming and I think we have achieved a great deal here in outlining the problem and,as far as I can see, getting a program for remedial action, if all goes well, as much as I like this place, I like Savannah and hope to be here again, I hope I won't have to come down here in an official capacity again and I have every confidence that with the excellent programs you have in South Carolina and in Georgia, that this will not be necessary.

I would like to again for myself call your attention to what I think is one of the great attributes of our country in

American democracy where we have municipalities, states and the Federal Government all not having perhaps the same philosophy, as may have been evident in the presentations and the discussions here, and yet being able to, when a law is passed, to get together and come together in a forum and in a reasonable way discuss the problem and come up with a formulation of mutual accommodation and I would like to extend my thanks to the representatives of the states, Dr. Venable, Mr. Howard, Mr. Linton for their statesman-like attitude in really being dyed-in-the-wool States Righters and protecting the interests as they saw them of their citizens and constituents.

If there is nothing further, I think we will stand adjourned, and thank you all for coming.

(Whereupon, at 2:45 o'clock, p.m., the same day, the above-entitled matter was adjourned.)

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CERTIFICATE

I, L. Lee Lawson, do hereby certify that I was present at the time and place first hereinbefore set forth, the aforementioned parties appearing, that I took down in stenotyping the entire proceedings had at said time and place, afterwards transcribed said notes: and that the foregoing 155 pages constitutes a true, correct and complete transcript of my said notes.

Lleelawson

L. LEE LAWSON

February 8, 1965